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A Troubled Year in the Steel Trade

Little Progress on the Road to Readjustment —Strife Over Prices Dominates First Half and Steel and Coal Strikes the Second Half

THE American iron trade expected that 1919 would be a year of readjustments after more than three and a half years of prodigious war effort. There were some readjustments, it is true, but the year ended with far less accomplished in laying a good foundation for peace-time operations than had been expected. It was a year of strife over steel prices, of strife over steel works and coal mining labor conditions and of hamperings from railroad shop, dock and other strikes. Output of iron and steel works was cut down, largely because of labor troubles within and without the industry, and in the second half of the year the demand upon the country's steel capacity was greater than many in the trade had expected.

It came about, therefore, that as 1919 ended the steel companies were far behind in their deliveries, and, due to the scarcity of pig iron and of various forms of finished steel, prices were materially above those ruling as the year began.

1919 in Iron and Steel

Production was 75 to 80 per cent of the average for the great war years 1916, 1917 and 1918.

Prices tended down in the early months, became stronger after Government stabilizing failed, and on a "scarcity demand" moved upward in the last quarter.

A strike at many of the largest steel plants, beginning Sept. 22 and lasting into December, reduced output, in conjunction with a soft coal strike, more than 2,500,000 tons.

At the end of the year signs pointed to a continuing scarcity of steel in the first half of 1920.

Slackening After the War

Fifty days after the armistice, 1919 opened with the iron trade plainly slackening its pace. Though cancellations of war contracts by the United States and by the British, French and Italian Governments had poured in upon the steel companies in the closing weeks of the year, war work was still a very large factor in steel plant operations. Fearing the consequences of laying idle large bodies of workmen, the Government policy was to make gradual readjustments. It was believed that rolling mill operations would slow down further in the early part of the year. Peace demand at home could not materialize quickly to take the place of war orders, and it was already evident that European reconstruction would call for little American steel in 1919.

Price Reductions

Realizing that war prices were out of line with peace time, iron and steel manufacturers made reductions in the middle of December, 1918, ranging from $4 to $6 per ton on finished material. These were recommended by the general committee of the American Iron and Steel Institute, and were announced by the steel men at a final conference with the War Industries Board at Washington on Dec. 15, 1918. The War Industries Board, which had fixed steel prices, ceased to function on Dec. 31. In anticipation of the board's going out, the general steel committee and all its subcommittees, which had had to do with prices under Government control, disbanded on Dec. 21.

This left an open market on iron and steel products, and it was freely predicted that the prices prevailing at the opening of 1919 would yield still further whenever any attractive business came up. For several weeks trade drifted on. Much was said in the newspapers about finding places for soldiers returning from France. The fear was commonly expressed that as industry slackened and war workers were laid off, it would be difficult to place the fighting men when they came back looking for work. So far as the iron and steel and metalworking industries were concerned there was little or no complaint of soldier unemployment. For more than half the year steel works labor supply, particularly common labor, was less than the demand.

The Price Stabilizing Episode

In all the discussion of unemployment it was emphasized that the price situation had a very important bearing on the rate of operation in industry. It was argued that as readjustments from war prices were generally expected, buyers in all lines would place orders sparingly and industry meantime would limp along. Both the Department of Commerce and the Department of Labor at Washington were active in the public discussion of unemployment as related to prices. The Department of Labor carried on widespread propaganda, urging that high

level prices were no temporary thing and that buyers might as well make up their minds to "buy now" for free replenishment of stocks.

Secretary of Commerce Redfield, realizing that manufacturers were holding back with purchases of raw material and that dealers, large and small, were carrying small stocks and hesitating to place new orders, called a number of business men to Washington to consult on the situation. He advocated a price stabilizing movement "for the purpose of preventing unemployment to the largest extent and of accelerating market conditions." He characterized the reports of market stagnation as alarming, and intimated that unemployment would help Bolshevik agitation in industrial centers to make headway. Early in February Secretary Redfield cabled President Wilson, who was in Paris, suggesting the appointment of a commission to work out a schedule of price reductions. A little later, after full consideration of the matter by the Cabinet, the Industrial Board of the Department of Commerce was created in pursuance of the Redfield plan.

This board started out to hold conferences with representatives of various industries. One of the first of these was with a committee of steel manufacturers appointed at a meeting called by President E. H. Gary of the American Iron and Steel Institute. The steel committee met the Industrial Board at Washington on March 19. On the afternoon of March 20 the Industrial Board announced reduced prices on iron and steel products as agreed on in this conference. These reductions ranged from $4.25 per ton on pig iron and $5 on billets to $10 on standard rails, and amounted to $7 per net ton on plates, structural shapes, bars, wrought pipe, sheets and tin plate, and to $5 on wire, wire nails, hoops and light rails. It was believed that the announcement of these prices would bring out a moderate amount of new business which buyers had been holding up in the six or seven weeks of agitation of the Redfield plan. This actually happened, but the demand was not broad.

Railroad Administration Defeats the Plan

It had been argued from the beginning by Secretary Redfield that while the reduced prices decided on by the Industrial Board would not be binding on anyone, the Government would purchase at those prices and thus they would be commended to the public as fair and likely to be maintained. This expectation was given a serious blow by the refusal of the Railroad Administration early in April to pay for rails the prices announced on March 20, which were $45 for Bessemer and $47 for open-hearth rails. Conferences followed with the hope on the part of the Railroad Administration that lower steel prices might be secured, but the steel manufacturers replied that prices could not be lowered unless wages were reduced. The final blow to the price-stabilizing plan was given by the publication of an opinion from the Attorney General that it was in contravention of the Sherman Act. He further held it to be illegal on the ground that it planned to evade 30 specific statutes requiring the Government to buy under competitive bidding.

The wrangle at Washington between the Railroad Administration and the Industrial Board lasted several weeks. Finally the members of the Industrial Board resigned and with the acceptance of their resignations by Secretary Redfield on May 9 all Government efforts at price stabilizing were abandoned.

In the latter part of May signs of better buying appeared in the steel trade, bearing out the views of many who held that one of the chief obstacles to business for weeks had been the attempt of the Government to interfere with the natural processes of trade. The most significant evidence of better business was the placing of contracts late in May by three large automobile companies for various forms of steel amounting to more than 1,000,000 tons.

Production

In output of iron and steel 1919 fell far behind the average of the great war years, 1916, 1917 and 1918. Pig iron production was about 30,900,000 tons and steel ingot production probably 34,000,000 tons. Comparison with the three preceding years is shown in the following:

	Pig Iron Gross Tons	Steel Ingots Gross Tons
1916	39,434,797	41,401,917
1917	38,621,216	43,619,200
1918	39,054,644	43,051,022
1919	30,900,000*	34,000,000*

*Estimated.

Lake Superior iron ore shipments by water were about 47,000,000 tons for the season of 1919 against 61,000,000 tons in 1918.

The situation as to output for 1919 was, briefly, that in the first half of the year demand was insufficient to keep blast furnaces and steel works going at anything like full capacity, and that in the second half, particularly in the last quarter, with demand constantly increasing, the steel strike, which cost about 2,500,000 tons in production, and the coal strike at bituminous mines, lasting from Nov. 1 to Dec. 10, prevented the works from reaching normal output.

There were wide fluctuations in the number of active blast furnaces. How the blowing out movement in the spring of the year was balanced by a blowing in movement in the fall appears from a loss of 54 furnaces in April and a gain of 51 furnaces in October. The variations in pig iron production appear in the following statement of the number of furnaces in blast at the beginning of each month:

Jan. 1	350	July 1	200
Feb. 1	323	Aug. 1	239
March 1	306	Sept. 1	265
April 1	266	Oct. 1	162
May 1	212	Nov. 1	213
June 1	195	Dec. 1	249

Steel Corporation's Price Policy

The Steel Corporation's policy in respect to iron and steel prices in 1919 calls for mention. In the early months of the year when there was more or less question about the holding power of the prices announced by Judge Gary at Washington on Dec. 15, 1918, the Steel Corporation was credited, and apparently rightly so, with refusing to go below those prices in order to get business. It evidently had decided to follow its well-known policy of conserving values. Occasionally competitors were mystified by the amount of the unfilled orders reported by the corporation, but it finally appeared that these were not due to price-cutting on new business but to the reinstatement of old contracts, some of them dating back many months. These contracts included a good many rail orders taken at less than $47 for open-hearth rails.

In the second half of the year, when it became plain that the steel that could be rolled before Jan. 1 would fall far short of meeting deliveries due on 1919 contracts, the Steel Corporation rigidly held to the prices of March 21. Some independent producers pursued in the main the same policy, since, owing to the steel strike and fuel scarcity they had large deliveries to make of steel booked at these prices. In other cases, where mills were not booked far ahead, buyers were so urgent that higher prices were established. Thus there was considerable variation in market prices. In wire nails conspicuously, while the Steel Corporation's price was $3.25, its competitors obtained $4.50, and there were instances in which $7 or more was paid.

Plates gradually moved up, and at the close of the year while the Steel Corporation was selling to ship-

yards at 2.50c. other plate mills realized 3c. and in some cases more. Bars held at 2.35c. by the Steel Corporation were bringing 2.75c. in sales made by other mills. Sheets were particularly hard to get, and offers of $30 a ton above the March 21 level were made by automobile makers.

The argument in favor of holding down prices of steel was that advances would simply bring further advances in wages and thus make another round in the vicious spiral. Those companies which realized higher prices took the position that as there was an open market the relation of supply and demand should rule; they pointed also to advances in their costs due to higher fuel and to interrupted operations. Looking forward a little, they saw a further advance in freight rates.

Pig Iron Advance

The past year was like 1917 in the fact that it was characterized by high prices during most of the twelve months. In fact, the two years 1917 and 1919 established new records for prices since the Civil War, but they were quite different in production. While in 1917 the average daily output of coke pig iron was below 100,000 tons in only two months, February and December, the daily average in 1919 was above 100,000 tons in only two months, January and February, while in October, due to the steel strike, the daily production was only 60,115 tons, the lowest daily figure for nearly five years.

The new schedule of prices, making a $3 reduction on pig iron, was effective Jan. 1 and the market dragged for several months. Customers insisted upon their contracts being revised and this demand was made again when the schedule of March 21, making a $4.25 reduction in pig iron, was announced. In the Central West this second concession was quickly granted, but Eastern furnaces moved more slowly, and for a time added the freight rate from Pittsburgh. Buying was at low ebb until June, when demand for nearly all grades, especially basic, showed improvement. Prices became normal but did not advance to any marked extent until after the workers struck on Sept. 22. As a result of that strike production decreased, showing a loss of 600,000 tons in October as compared with September, although September was about 200,000 tons below August. As the steel strike waned, the coal strike came on, and it was evident that the production would not be equal to the demand. Consumers for the most part were busy and were eager to buy iron. Their insistence resulted in rapid advances, amounting to from $10 to $12 per ton in the last quarter, so that at the close of the year prices on Northern foundry grades were fully $40 in almost all producing centers, while steel making irons were nearly as high. Southern iron had advanced to $36 at furnace. The year closed with an exceedingly strong market.

Chief Sources of Demand

Plates were a spectacular figure in the market in the last two years of the war, in view of the furious rate of shipbuilding; but they held a less important place in 1919. When the war ended the shipyards had large stocks of plates on hand so that for the first few months of last year the plate mills had rather poor operation. A reasonable amount of steel car work would have helped out, but car orders were not forthcoming. When the scarcity of all kinds of steel developed in the second half of the year, plate mills had a better relative showing. There was some demand from England, and Japan was a consistent buyer in this market.

Shipyard operations were carried on at a good rate throughout the year. The Emergency Fleet Corporation delivered 748 steel vessels, with a total of 4,893,000 deadweight tons in 1919, and at the opening of 1920 has on its program 48 ships for which keels have not yet been laid. At the same time there are under construction in American shipyards 1,200,000 deadweight tons of sea-going vessels on orders from private companies.

Late in May the Railroad Administration placed 200,000 tons of open-hearth rails with the mills, paying under protest $47 per ton. Something like 100,000 tons of rail orders were placed by the Railroad Administration later in the year.

Car and locomotive works had a poor year. The Railroad Administration started on 1919 with a large number of cars which it had ordered in 1918 still in the yards of the car builders because they were built at such high prices that various railroads refused to allow them to be charged to their accounts. These cars were absorbed in 1919, but few new orders came out, though some of the railroads built cars on their own account.

A good deal was said about Europe's requirements in locomotives and cars but little materialized. Poland negotiated for both cars and locomotives and it was at one time reported that a ten-year credit had been arranged, but this plan has not yet been carried out. In December Belgium placed 150 locomotives with two American builders and may buy 50 more. The equipment companies are looking for a large business in 1920 with the restoration of control of the railroads to their owners. Rail orders pending at the close of 1919 were estimated at close to 1,000,000 tons.

Conspicuous customers of the steel companies throughout 1919 were the automobile builders. Automobiles were the most conspicuous factor in the generally extravagant buying indulged in by the public throughout the year. Sheet mills were constantly under pressure from automobile builders and in the latter part of the year some works at Detroit had to limit their production because of inability to get sheets. The total consumption of steel for passenger automobiles built in 1919 was about 1,200,000 tons.

Export Trade

The exports of iron and steel naturally fell off after the war, but they amounted to more than many in the trade had expected. Of products reported by weight the total exported in the ten months ending Oct. 31 was 3,908,000 tons, against 4,531,000 tons in the first ten months of 1918. The values of all iron and steel exports were $834,000,000 to Oct. 31, as against $870,000,000 for the first ten months of 1918.

Iron and steel imports increased after the war, being 245,000 tons for the first ten months of the year, as against 140,000 tons for the first ten months of 1918. There were fluctuations in the export movement of 1919 due to shipping conditions. The longshoremen at New York were out on strike for most of September and October, which considerably reduced shipments. The table below shows how the export movement in 1919 compared month by month with that of the war years 1917 and 1918:

Exports of Iron and Steel—Gross Tons

	1917	1918	1919
January	608,286	495,345	360,456
February	449,104	440,532	234,793
March	606,560	382,195	344,506
April	521,176	465,865	408,204
May	587,900	493,241	447,050
June	631,712	421,963	544,580
July	349,649	457,233	287,823
August	522,810	511,858	396,743
September	489,415	473,066	363,505
October	571,893	388,777	302,456
November	473,929	448,716	.....
December	656,044	357,703	.....

The Pittsburgh Base Attacked

What is known as the Pittsburgh basing case came up before the Federal Trade Commission in the summer

(*Continued on page* 43)

Enlarged Fleet of Ore Boats Plying Hudson

All-Water Route for Iron Ore from Port Henry to New York Harbor—Details of Notable Dock and Handling Equipment

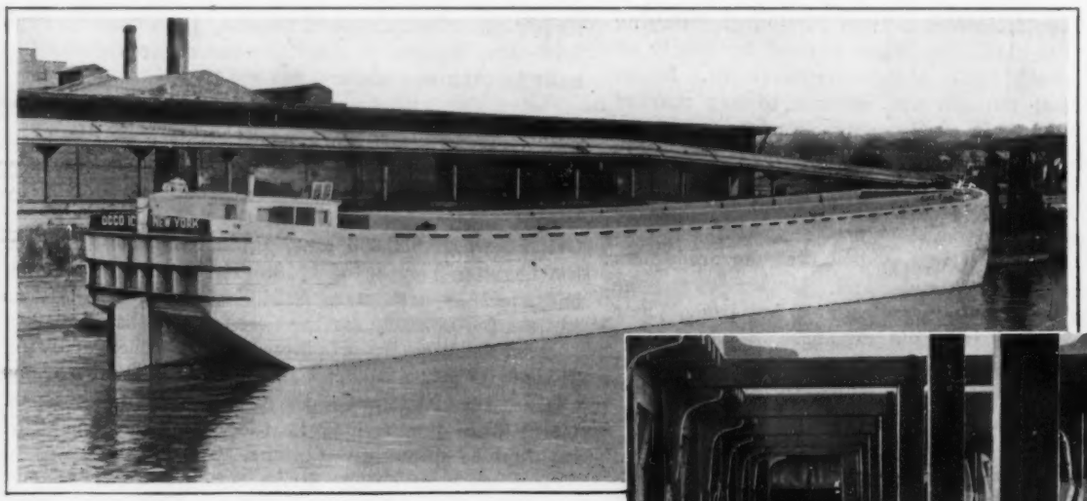
WITHERBEE, SHERMAN & CO. now have a fleet of ore boats capable of moving 150,000 to 175,000 tons of iron ore each season from their dock at Port Henry, N. Y., to New York harbor, where the ore is transferred to cars for shipment to eastern Pennsylvania furnaces. These water shipments were made possible by the completion of the enlarged Champlain Canal, which has its northern terminus at Whitehall, N. Y., at the foot of Lake Champlain. The original Champlain Canal was built in 1817-1823 to connect Lake Champlain with the Hudson River, its length being 61.5 miles. As enlarged this canal has the same depth as the Erie Canal and has locks of equal dimensions. Between Whitehall, N. Y., and Waterford on the Hudson River, just above Troy, there are 11 locks, each 310 ft. long and 45 ft. wide.

Witherbee, Sherman & Co.'s transportation of ore is carried on under the name of the Ore Carrying Corporation and the latter's boats are known as the Occo fleet. Two Erie Canal cargo steamers with four consorts each were bought and operated in 1916. These were 98 ft. long and 17 ft. 6 in. beam. The next year a steamer and five consorts were added, making a total of three steamers and 13 barges. Later a steamer and four barges, known as Occo 100 to 103, were built. These were designed by Theodore E. Ferris, who had taken up the problem for the company with a view to developing a type of boat for the carrying of ore at the least cost per ton at the most economical speed. Mr. Ferris's decision bore out the conclusion the owners had reached from their experience—that the best results would be secured from a fleet of four boats (one a steamer) of a size to fill a canal lock completely. The length over all is 152 ft.; the beam, 22 ft., and the molded depth at side center, 12 ft. 9 in. The most economical speed was found to be between six and seven miles per hour, running loaded.

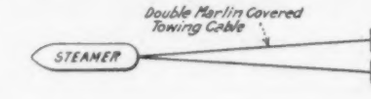
Why Wood Was Used for Hulls

Concerning the choice of wooden boats, L. W. Francis, president Witherbee, Sherman & Co., commented as follows in an address before the New York State Waterways Association:

"Steel, wood and concrete were carefully studied as materials to be used in construction. Modern marine practice favored steel, but owing to war conditions, steel was very expensive and practically unobtainable; aside from original cost, however, steel hulls were not considered the best for canal boats running in very shallow water, as

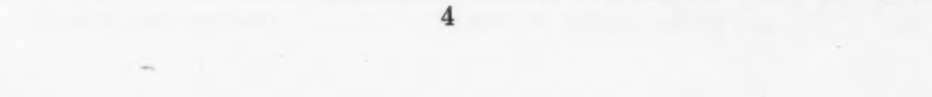


Wooden Barge Adopted as Standard Has 152-Ft. Length Over All, 22-Ft. Beam and 8½-Ft. Draft for a Normal Load of About 500 Tons. Framing of hold, shown at right, permits loading and unloading by bucket



Pushing Method for Fleet on Barge Canal, Shown Above. Proposed method of towing between Troy, N. Y., and Elizabethport, N. J., for season of 1920, shown below

Courtesy of Popular Mechanics Magazine



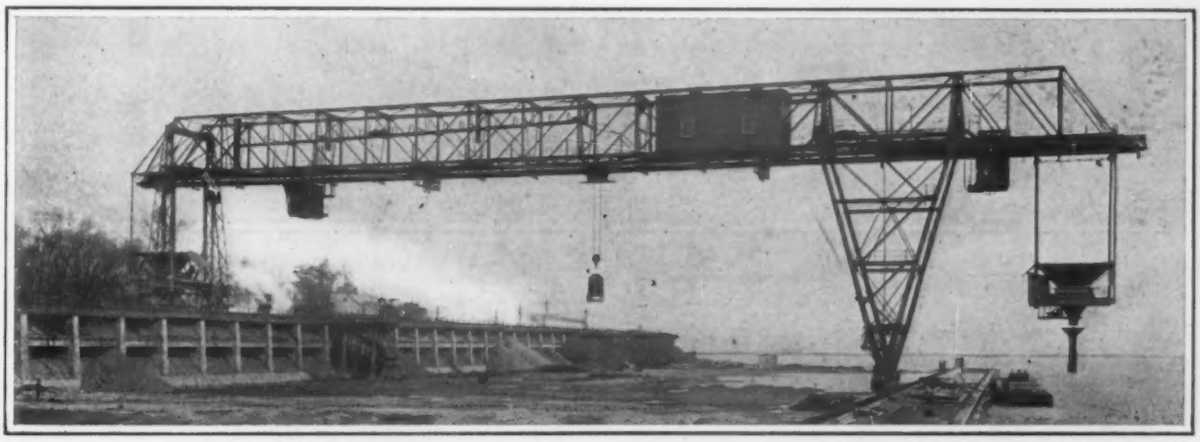
Section of Dumping Trestle Designed with Reinforced Concrete Aprons Which Throw the Ore, Discharged from Hopper Cars Overhead, to the Ore Trough in Foreground

it was feared that temporary obstructions in the canal might damage the bottoms, especially in the canalized river sections and through rock cuts; and as no adequate repair shops are located along the line the risk was thought to be greater than necessary. Concrete, while the cheapest in original cost, was at that time practically untried, and a boat designed to withstand the heavy stress and strain of iron ore cargoes had a carrying capacity of about 20 per cent less than a wooden boat of the same dimensions, thereby increasing the operating costs in proportion. New aggregates and methods of construction will undoubtedly remove or minimize these objections and it is possible, if not probable, that concrete boats will some day be successfully navigated upon the canals. Were it not for the great weight of iron ore per cubic foot it is possible that this type of boat might have been selected because of quick and comparatively easy construction. Wood, however, was chosen as it was the material most widely used in canal craft and the hulls were laid down as rapidly as timber could be secured—not an easy undertaking in war times."

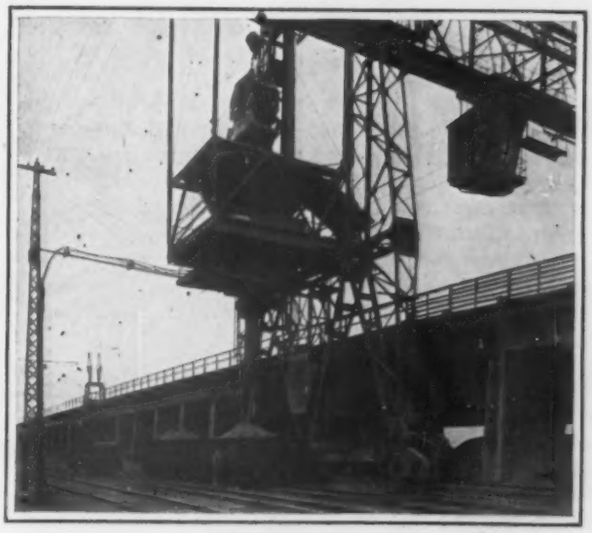
The hulls of the steamer and barges were made practically identical except for the stern, the steamer having a 44-ft. run and the barges a rake stern. The hatches are large to permit of the operation of grab buckets. Fuel oil is used by the steamers and the tanks have a capacity giving a steaming radius of 100 miles, whereas the distance from Port Henry to New York harbor is 270 miles. The power equipment of the steamer is the following: One fore and aft compound engine, 15 x 30 x 22 in., and two Almy water-tube boilers, 150 lb. working pressure, 3220 sq. ft. of heating surface. There are a combined air and circulating pump, a horizontal simplex main feed pump, a fire and bilge pump, sanitary pump, oil feed pumps and heaters for handling oil fuel for the boilers, a 7½-kw. generating set for electric lights and searchlight, and steam steering gear.

The crew for the 152-ft. steamer and three consorts consists of 15 men—captain, mate, engineer and assistant engineer, three firemen, two oilers, a cook, two deck hands, and one man on each barge. The carrying capacity of a fleet of four such boats is about 2000 tons on an 8½-ft. draft. A fleet of the smaller boats would carry about 1050 tons, making the round trip in about ten days. The fleet of the larger type will probably make the round trip in a week under standardized working conditions.

The unloading point for the Occo ore fleet is Elizabethport, N. J., on Newark Bay, where the Central Railroad of New Jersey has equipped its docks with Brown unloaders. These transfer the ore to cars for delivery to blast furnaces at Lehigh Valley and other eastern Pennsylvania points.



The 330-Ft. Bridge Tramway Equipped with 5-Ton Bucket Capable of 60 to 85 Round Trips per Hr., Loading Either to Barges at Right or to Freight Cars Behind 900-Ft. Trestle at left



Hopper and Automatic Recording Scales on Dumping Trestle in Position for Loading Rail Shipment

Of interest in connection with the operation of the ore fleet is the ore dock at Port Henry, N. Y., of the Lake Champlain & Moriah Railroad Co., owner and operator of the railroad which carries iron ore from Mineville, N. Y. At the latter place are the mines of Witherbee, Sherman & Co. and those of the Port Henry Iron Ore Co. Formerly all the ore carried to Port Henry over this road was loaded in Delaware & Hudson cars. Now it can be loaded in cars or boats with equal facility. Incidental to the ore dock are notable facilities for ore storage and modern ore-handling equipment.

Equipment for Loading Boats or Cars

The dock is 307 ft. 4 in. wide from its front to and including the railroad yard at its rear, and is 900 ft. long on the front, with a wing wall extending diagonally from the northern end back to the shore line. The southern end of the dock abuts on an old slag pile of the Cedar Point furnace.

The ore is delivered in self-cleaning steel hopper cars to the dumping trestle at the rear of the dock and discharged over aprons to the ore trough at the base of the trestle. The trestle is 900 ft. long, exclusive of approaches, and is built with concrete piers, reinforced concrete aprons and I-beam track girders. The south end of the trestle is connected to the railroad system of the Cedar Point furnace, thereby permitting the delivery of ore direct to that furnace. The floor of the ore trough consists of concrete with rails embedded therein.

A bridge tramway of 243 ft. span and 330 ft. overall length transfers the ore from the ore trough to the stock pile, or to the boats at the dock front or railroad cars in the yard at the rear of the trestle; likewise ore may be transferred from stock pile for either water or rail shipment. The tramway is equipped with a 5-ton bucket and is capable of making from 60 to 85 round trips per hour, dependent upon the location of the loading and discharging points.

Hoppers and automatic recording scales are provided at each end of the tramway, thus enabling the ore to be weighed for both water and rail shipment.

Trackage and Shifting Arrangement

For the accommodation of railroad cars, a two-track yard, with frequent crossovers, is provided at the rear of the dumping trestle. Between these two tracks an electric locomotive operates, the locomotive being provided with pusher arms pneumatically operated so as to engage the end sills of the cars and thus accomplish all shifting operations required. The locomotive weighs 17 tons and is of sufficient power to push four 100,000-lb.-capacity cars, fully loaded.

Both the bridge tramway and the pusher locomotive operate on 220-volt direct current, the former taking current from conductor rails suspended from the sidewalk on the trestle and the latter operating from double overhead trolley wires carried by steel poles and brackets.

The main dock construction is of the timber pile, relieving platform type, with concrete front wall and concrete wall for carrying the bridge tramway rails. Over 6000 piles were used.

The entire area is underlaid with rock at varying depths, with a maximum of 70 ft. below low water, and all piles were driven by steam hammer to a bearing on the rock. The timber platform on top of the piles extends about 50 ft. back from the front wall. In the rear of this relieving platform nine rows of piles were driven and cut off at bottom of the lake, after which they were covered with a rock blanket of about three feet in thickness, thus preventing the weight of the ore from being carried on the natural ground until a point had been reached approximately 90 ft. back from the dock front.

The Electric Pusher Locomotive Running on a Special Track Between Two-Track Railroad Yard Can Shunt Four 100,000-Lb. Capacity Cars, Fully Loaded

The dock structure is also secured by wrought iron tie rods, 85 to 100 ft. long, which are attached to the rear of the relieving platform and anchored to dead men buried in the earth.

The channel depth of 12 ft. along the dock front and approaches was excavated by a suction dredge, the dredged material being wasted along the shore. The area of the dock will be filled and brought to grade by stone and tailings from the ore mines, the fill being placed by the bridge tramway.

The dock and its equipment were designed by and built under the supervision of Frank C. Roberts & Co., engineers, Philadelphia. The contractor for the major portion of the work was the New York State Dredging Corporation and the contractor for the bridge tramway was the Link-Belt Co.

The electric steel works of Peter A. Frasse & Co., 695 Capitol Avenue, Hartford, Conn., are to be taken over by the Frasse Steel Works, newly organized with an authorized capital of $1,000,000. The present plans of the new company call for immediate expansion to provide for an output at the rate of 30,000 tons per annum. The capacity of the plant to-day is 15,000 tons annually. Subsequent expansion will provide for an output of at least 100,000 tons annually before the close of 1920.

The Infant Steel Industry of Australia

Two Producing Plants and a Third Expected—Six Months Idleness in 1919 Due to Strikes—Isolation and Labor Unions Are Great Handicaps

BY CLEMENT F. POPPLETON

IN the commonwealth of Australia at the present time two iron and steel companies are operating on a commercial scale. The first in tonnage is the Broken Hill Proprietary Co., Ltd., whose steel plant is at Newcastle, New South Wales; the other is John Hopkins & Sons, whose plant at Lithgow, New South Wales, produces small shapes and bars.

The Queensland Government has authorized the manufacture of iron and steel as a state undertaking, but, although a large amount of preliminary work has been accomplished, no actual production was in progress when the writer left Australia late in August. The Queensland project comprises two 350-ton blast furnaces, open-hearth plant, rail mill, shape mill, bar mill and a plate mill. At its head is Mr. Brophy, formerly of the Tata Iron & Steel Co. at Sakchi, India, which he left to take up the position of master mechanic of the Broken Hill Proprietary Co. plant at Newcastle, leaving this to assume his duties with the Queensland Government in December, 1918.

MR. POPPLETON, who designed a number of tin plate plants now in operation in the United States and in Great Britain, went to Australia in 1918 to take part in the planning and construction of a tin plate mill for the Broken Hill Proprietary Co., Ltd., at Newcastle, New South Wales. He had good opportunities for learning the actual facts as to the progress made in establishing the manufacture of steel in the commonwealth. His article very interestingly discusses the handicaps under which operations have been carried on, particularly in the past year, and the light he throws on the labor situation in Australia points to a continuance of these hamperings.

The effort to establish diversified finishing mills in Australia and the bounty to sheet manufacture, passed one year ago, are noteworthy.

Broken Hill and Lithgow Works

The Broken Hill Proprietary Co.'s plant consists of two blast furnaces of 350 tons capacity, open-hearth furnaces, a blooming mill, rail mill, shape mill, and 18-in. bar mill. Late in 1918 a rod mill was added, which was built by the Morgan Construction Co., Worcester, Mass. The latter company sent over an erecting force under Mr. Bloom, who completed his work and returned to the United States early in 1919. The Broken Hill Proprietary Co. also operates its own by-product coke plant. Its iron ore is obtained from the Hummicky Hill district in South Australia.

At Lithgow, John Hopkins & Sons operate two small blast furnaces, open-hearth furnaces, a blooming mill, small shape mill, a bar mill and a very small plate mill. The plate mill ran its last in March, 1919. It was very antiquated and inefficient.

Blast furnace capacity is lacking at the Lithgow plant. There are raw materials—ore, coal and limestone—available to largely increase the pig iron production throughout the commonwealth, but uncertainties as to labor and transportation give the capitalist pause as to the investment in mills, furnaces and equipment.

Too Much Diversification in Product

There is an ample market in Australasia for treble the present and projected output of steel products. As was to be expected, the plants have endeavored to make too diversified a product; it would have been far better to confine efforts to rails, shapes and bars for the product of the Broken Hill Proprietary Co.'s two furnaces and to limit the range of these rails, shapes and bars to fewer sections, leaving the larger range of products until such time as more steel was available. This course would have given a larger percentage return on the capital invested and a greater output per mill, owing to the time saved in roll changing.

This condition was obvious to others and there was a conference between the heads of the various Government railroads and other officials, private architects and engineers, and the managements of the mills with the idea of reducing the number of sections rolled and standardizing such as were rolled.

The Broken Hill Proprietary Co., having the heaviest equipment, would naturally have taken care of the heavier sections, leaving the lighter sections to Lithgow. There were obstacles in the way of this course, and at the time I left finality had not been reached; but something along these lines will be better for the commonwealth. There is no adequate reason for the Broken Hill Proprietary Co. and Lithgow both rolling out-sizes, say 6-in. x 6-in. x 1-in. angles, where the Government could fix the price per ton for each plant, that is, for its own requirements. Outside competition from overseas would regulate the commercial prices to private consumers.

Railroad Handicaps

The difficulty in transportation of raw materials and finished products in Australia is a matter of great moment. All the railroads in the commonwealth have followed the English system. Four-wheel cars of 10 tons capacity are the base of the rolling stock. It seems archaic to the observer who has seen efficient methods to observe train load after train load of coal cars whose loads vary from 6 to 10 tons and whose tare weight is sometimes 10 tons and never less than 6 tons. Practically all of the coal cars are wooden.

Coal traffic in the commonwealth has always a return empty haul, and this haul reaches 50 miles, so that, taking the worst, the dead haul is 22 tons over 100 miles to deliver 10 tons of coal 50 miles, whereas a 100,000-lb. capacity car of steel construction can be built with a tare weight of 30,000 lb., which gives 160,000 lb. dead haul over 100 miles to deliver 100,000 lb. of coal 50 miles, a net gain of 36.6 per cent in favor of the larger car.

There are a few privately owned coal cars of 40,000 lb. capacity of steel construction, notably of the Broken Hill Proprietary Co. For deliveries of finished products the railroads have an inadequate supply of cars. The 30-ft. standard lengths of rails, shapes, etc., cannot be transported on the 10-ton capacity standard high-sided gondola cars which comprise the bulk of the rolling stock of the railroads of the commonwealth. This con-

dition makes it necessary for the railroads to undertake a very large outlay for new rolling stock, but capital is not immediately available.

Even were the products of the blast furnaces and steel works all shipped by sea, there would still remain the difficulty of distribution from the port of destination. Again, the gages of the railroads are not standard, ranging from 3 ft. 6 in. to 5 ft. 3 in., which necessitates a change of loading at certain points. At Albury the New South Wales Government Railway, which is 4 ft. 8½ in. gage, transfers to the Victorian Railway, which is 5 ft. 3 in. This gage is maintained to Adelaide, where the West Australian gage, 4 ft. 8½ in., is again encountered. This confusion in gages of railroads has limited the development of the commonwealth as a whole.

Industry Too Largely on the Coast

One of the greatest troubles is the centralization of manufacture. All the present manufacturing plants are situated on the coast, and as it is obvious that Australia must become a manufacturing country, the natural tendency would be for the newer manufactures to settle near the ports also.

It may be taken as axiomatic that it is better to pay freight on the finished product than to pay freight on raw material, particularly when it will be necessary to find means for disposal of the wastes after the manufacture is completed. The transshipment of wool and wheat from one railroad gage to another is a severe tax in itself. Australia cannot afford to ship her wool in the future as she has in the past, and it would be better for the people to spread out manufacturing rather than follow the present system. Woolen mills located on fresh water sites would be far more profitable than if the raw wool were shipped to the already overcrowded trade centers of Adelaide, Melbourne, Sydney and Brisbane. Also the cost of living would be reduced, the standard of comfort of the workers would be increased and freight on raw material could be materially reduced.

The press of the commonwealth is practically unanimous in advocating decentralization. The railroads run for miles through territory which is not freight-producing, whereas if the woolen mills, etc., were established away from the coast, nearer to the stations, it would follow that communities would grow up surrounding the source of employment and that the necessary supplies for these communities would necessitate another freight movement, and materially decrease the empty haul feature, now so distressingly prevalent.

There would be also a natural tendency to closer settlement of the land in smaller parcels than the prevailing sheep and cattle stations, and wheat lands, leading to more diversified employment, such as small machine shops, and even agricultural implement works and the like.

Importers vs. Manufacturers

The press of the commonwealth has its pet stalking horse, the "importers' ring," taking the place of the "interests" in the United States. Several very large fortunes have been built up by these exporting and importing firms, many of which have large London houses. They buy up the wool and wheat and ship as their own proper business, paying railroad freights and selling at the market in London, Bradford, or Liverpool through their London houses.

The Australian houses secure orders for heavy machinery, etc., from the squatters and buy from the English manufacturers, making another profit. For smaller supplies, such as galvanized sheeting, wire netting, paints, oils, etc., they obtain exclusive agencies from the manufacturers in England and retail these products to the squatters and smaller merchants in the inland towns. Australia is probably the greatest per capita user of galvanized corrugated sheets and galvanized wire netting in the world. The houses in the bush are practically all roofed with galvanized corrugated sheeting, which is also used very largely for veranda roofs, even in the cities. There is a striking lack of variety in the architecture of the commonwealth generally. One class of house and its neighbor are as nearly alike as two peas in a pod. Galvanized wire rabbit netting, which is 1⅝ in. mesh, 30 in. wide, is sold by the mile.

Under these circumstances it is natural that the "'importers' ring" should discourage as much as possible the establishment of manufacturing plants in the commonwealth, and labor plays into the importers' hands by putting every possible obstacle in the way of new manufacture.

There are projects under way to establish the galvanized iron industry on a large scale (John Lysaght, Ltd.) and two wire netting plants are also projected. Several plants for manufacturing agricultural implements, plows, etc., are located near the ports and add to the congestion, but the bulk of the requirements are imported.

Domestic Iron and Steel Products

The products of the Broken Hill Proprietary Co. comprise rails, shapes, rods and flat bars. The company's policy is to attract subsidiary corporations to its site and supply such corporations with the semi-finished material.

The Austral Nail Co., whose plant was practically completed at the time I left, is to get its supply of rods from the Broken Hill Proprietary Co. and drawing the rods into wire. This plant should be at least in partial operation by this time, but of this the writer has no definite advice by the last mail.

The corporation of John Lysaght, Ltd., which operates large plants in England at Bristol, Wolverhampton and Newport, is also establishing a plant for the manufacturing of sheets, black and galvanized. This plant will adjoin that of the Austral Nail Co. Operations on the foundations were begun in July. This firm will draw upon the Broken Hill Proprietary Co. for its semi-finished material supply in the shape of sheet bars. There is also a tin plate plant projected which will be located between the steel works and the plant of John Lysaght, Ltd.

The relative positions of the Broken Hill Proprietary Co.'s proposed tin plate mills, the Austral Nail Co.'s plant, already completed, and the proposed Lysaght plant are shown in outline in the accompanying illustration.

The Broken Hill Proprietary Co.'s steel works are located at Port Waratah, on the northwest of Newcastle harbor, on the Hunter River. The major portion of the raw material is received and product shipped by sea.

Immediately opposite the blast furnaces and separated therefrom by the Hunter River is located the Commonwealth Shipyard, Walsh Island. This was established by the Commonwealth Government as a war measure and was not a very brilliant success. They launched one ship, the Delungra, which was entirely fabricated at the yard. The yard also did repair work, but the costs were out of all proportion to the value of the service rendered, both for new work and repairs.

The Broken Hill Proprietary Co. provided material for the Delungra, rolling the plates on the blooming mill. Of course, this was about as inefficient a method of rolling plates as could be thought of, but at the time, the early portion of the year 1918, it will be remembered that it was almost impossible to procure ship plates anywhere in the world. The shipbuilding program of the Allies called for more plates than the capacity of the plants could take care of. Great Britain used all she could make and it was practically impossible to ob-

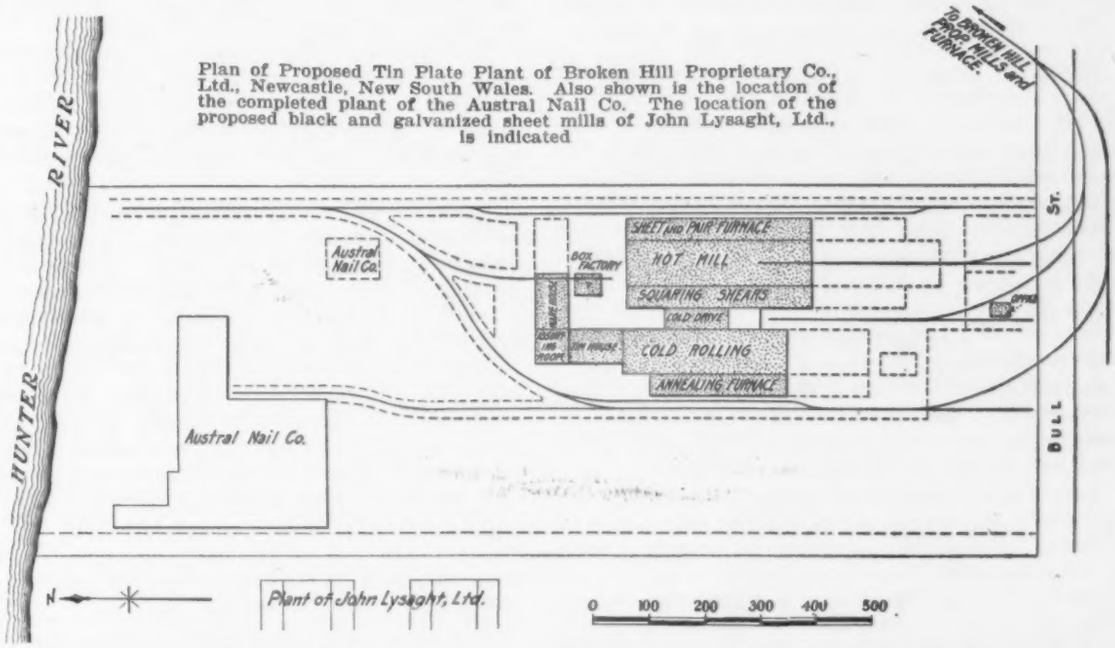
tain permits from the United States Government to ship any American rolled plates of shipbuilding sizes.

Need of More Blast Furnaces

David Baker, manager of the Broken Hill Proprietary Co.'s steel works, practically refused to commit his company to the continuance of the plate supply as soon as the armistice was signed. There is no basic reason why plates cannot be rolled in Australia, but there are several serious objections as things are conducted in the commonwealth.

In so far as the Broken Hill Proprietary Co. is concerned, the outstanding feature is lack of blast furnace capacity. The installation of a plate mill presents no insuperable obstacles, but the finishing mills already installed could absorb much more than the quantity of pig iron the two furnaces are capable of producing. A second and perhaps more serious feature is the labor situation. This labor question does not handicap the manufacture of plates alone, but all the steel and iron products of the commonwealth suffer in common.

Plan of Proposed Tin Plate Plant of Broken Hill Proprietary Co., Ltd., Newcastle, New South Wales. Also shown is the location of the completed plant of the Austral Nail Co. The location of the proposed black and galvanized sheet mills of John Lysaght, Ltd., is indicated



Blast furnace capacity is wofully inadequate at the plant of the Broken Hill Proprietary Co. If all the rails used in the commonwealth were rolled at the plant of the company, the rail mill alone would absorb the total production of the two furnaces. This, of course, would preclude the possibility of rolling shapes, bars, rods, or any other of the various tempting, because profitable, products of rolling mills.

This remark must in no way be construed as a criticism on the policy of the management of the Broken Hill Proprietary Co.'s plant. It must always be borne in mind that the past five years have been absolutely abnormal and that this abnormal condition was not confined to one plant or to one isolated country, but was common to the world.

Australia's Isolation

The geographical isolation of Australia rendered her position worse than that of other countries, and after the United States entered the war her only available source of steady and regular supply was cut off.

The normal source of supply for the commonwealth's requirements in steel products in ante-bellum times was naturally Great Britain; first, on account of the flag, and secondly, the commercial exchange of products, Britain taking Australia's staples in the way of wool and wheat in exchange for steel products and other manufactured or semi-manufactured material.

Of course, it is well understood that Australia is by no means a manufacturing country and has sadly neglected her opportunities in this respect, having been quite content to rely on the mother country for every commodity, shipping her main staple, wool, to Great Britain to be washed, spun, carded and woven, and reimporting the finished cloth instead of importing the machinery and making up the staple into the finished cloth and becoming an exporting country of such surplus as was not needed for home consumption. The war will have the inevitable result of changing this condition.

Australia is building up a tariff wall even against the mother country, allowing but a slight preferential in favor of goods of British manufacture.

Bounty on Sheet Manufacture

The Australian act granting a bounty for the manufacture of black steel sheets and galvanized sheets was passed Dec. 20, 1918. Provision is made for the payment of not more than £40,000 in any one year to Australian manufacturers of sheets. The period of bounty payments is to end Sept. 30, 1923. The bounty varies according to the fluctuations in the freight from ports in Great Britain from which sheets are usually shipped to Australia. The sheets of domestic manufacturers on which bounty is paid must be made from Australian iron ore and from steel manufactured in Australia or from such imported sheet bars as may be authorized. The act provides that the Australian minister shall decide when the conditions in the Australian steel trade are such as to warrant the use of sheet bars other than those made in Australia, in the manufacture of black and galvanized sheets. No bounty is to be paid if profits exceed 15 per cent per annum. It is provided that the Minister may make application to the president of the Commonwealth Court of Conciliation and Arbitration for a declaration as to what wages and conditions of employment are fair and reasonable for labor employed in Australia in the manufacture of black and galvanized sheets.

When the freight on sheets from British ports is £2 10s. per ton or under, the bounty is to be £1 10s. per ton. When the freight exceeds £2 10s. per ton the bounty is £1 10s. less the amount by which the freight exceeds £2 10s. For galvanized sheets the bounty is £2 per ton when the freight is £2 10s. per ton or under, and when the freight exceeds £2 10s. per ton, the bounty is £2 per ton less the amount by which the freight exceeds £2 10s. per ton. The bounty on galvanized sheets is

inclusive of the bounty, if any, paid on the black sheets from which the galvanized sheets are made.

Freight from Great Britain for August and September, 1919, ruled about £3, while from the United States freights were quoted at £1 15s. This latter rate would have to be figured on a base rate of exchange of $4.86, as the rate of exchange per pound sterling has varied in a more or less downward curve since that time and has reached $3.70. Freights were very erratic but falling rapidly.

In 1914 the freight on sheets and tin plate from Great Britain was £1 10s. with an upward tendency. It is fair to assume that the rate will settle to about £2 10s., owing to higher wages and higher cost of the commodities entering into the operation of steamers. On the same basis the freight rate from the United States would approximate £1 10s. per ton or the equivalent exchange value in dollars at the date of shipment. If sterling exchange were $4, then the freight rate would be $6 to the ship and would necessitate the importer paying £1 10s. in sterling.

Steel Works Labor Problems

There has been practically no tonnage production of iron and steel in Australia in the past, and as a natural consequence there is no field of skilled or semi-skilled labor to draw on. This, of course, means that all the leading hands have to be imported from Great Britain or the United States. This condition presents many difficulties apart from the cost of transportation and the bonus which would be required by these leading hands to induce them to undertake the trip. There stands the condition of the world's demand for steel products of all kinds and the shortage of skilled labor in the steel industry, which is world-wide.

In so far as the Broken Hill Proprietary Co.'s plant is concerned, these initial difficulties have been overcome in the case of blooming mill and open-hearth crews, rail and shape mill and rod mill crews.

Provision will have to be made by the Broken Hill Proprietary Co. for the tin plate mill personnel if it decides to install this plant, and by the Lysaght concern for the sheet mill. These two mills will be handicapped at the start to the extent of this extra wage and expense charge over the base scale of wages being paid in Great Britain or the United States. The Austral Nail Co., I understand, has made its arrangements for workmen.

In both the United States and Great Britain the base scales are away above those obtaining before the war, and so far as Great Britain is concerned these scales are not nearly stabilized. It would appear, therefore, that for the Broken Hill Proprietary Co.'s tin mill project the better recruiting ground for heaters, rollers, shearmen, picklers, cold rollers and tin house operatives would be the United States.

Shortsighted Union Policy

Australia is overridden by the labor element and the union leaders, in the writer's opinion, are sadly lacking in foresight. Whether intentionally or not, the basic idea seems to be to throw every possible obstacle in the way of developing the natural resources of the country. Instead of endeavoring to increase production to the limit, the tendency is to get as much wages for as little work as possible. This feature of the labor situation is not confined to Australia, but it is carried to a greater extent in the commonwealth than in any other country on earth.

The men seem to the writer to lack healthy ambition. In fact, the common remark is, "It'll do me," which is as frequent as the Mexican's "Quien sabe?" The labor leaders, all union, comprise many members of Parliament and have practically made the open shop non-existent.

The Australian Award System

There is apprenticeship for every trade or branch thereof, and the indentures are a prerequisite for employment in almost any capacity. The employers would rejoice in the chance to run the open shop and, judging from those I interviewed, would be perfectly willing to pay more than "award" wages, if they could see any assurance of really sustained effort to produce the maximum capacity of the mills.

The award system is very detrimental to production. The award is the living wage for any particular branch of the industry and is handed down by the court called the Commonwealth Court of Conciliation and Arbitration. It is based on the claims put forth by the workmen. They claim as debits, rent, transportation, provisions, clothing, etc. Then if the operation is such as involves an extra amount of wear and tear of clothing and shoes, that extra wear and tear is debited. If the work is extra hot, an allowance is claimed for such discomfort. If the work is extra laborious, that also must be taken into account. Thus is the base award for common or unskilled labor arrived at.

The court hears the evidence from the men as to the facts of rent, transportation, etc., and hears a representative of the employer in rebuttal of excessive claims for extra work, discomfort, wear and tear, etc. The court hands down its decision, which becomes the award.

When the operation advances beyond the capacity of unskilled and untrained labor, the operator makes a claim for such extra amount over the award as he thinks his skill is worth. The representative of the employer is heard in rebuttal, and the court in due time makes its award for that particular operation.

The court of necessity has little or no personal knowledge of what really constitutes the claim for extra skill, and as the Government of the commonwealth is run by the labor unions, the workman does not suffer in the award; that is, not as a general rule, since the Government appoints the court.

The unions frown on tonnage rates just as far as they are able, and in this they are supported by the men, who seem as a class content to go slow. The miners have a term for this—"darg."

Workers Not Home Owners

In the commonwealth the workers as a mass are not home-owners, preferring to rent, and the lack of ambition before referred to prevents a really systematic and sustained effort to obtain the best results for either the men or the owners of the plants.

There is also something to be said on the other side of the home-owning vs. renting question. Directly an industry establishes itself the available building land is gobbled up by land speculators who give as little as possible for the highest possible rent, and as the transportation facilities are very crude and expensive there is not the inducement for the men to purchase lots at a reasonable price and build their own houses. The Australian is content with far less comfortable surroundings than is his American confrère. The houses are built detached but shoulder to shoulder, without any breathing spaces between them.

In all the industrial centers I saw there was no general attempt to beautify the surroundings or to "make garden." Whether the men would take the trouble to make homes instead of mere dwelling places if the land owners and speculators would change their methods is a moot question, but it is natural to suppose that as long as inferior accommodation can be rented, better accommodation will not be provided. To find the equivalent of the American six-room house with bathroom and hot and cold running water is practically impossible.

Transportation is very inadequate, particularly sur-

face lines. Such as there are are operated under Government ownership and for all their inefficient service are usually run at a loss.

The fares are zoned, so that even if the land available on the outskirts were occupied it would not relieve the congestion immediately surrounding the plants, as the extra zone fare would involve a direct financial loss on the workmen other than the loss of time. This feature leads to the crowding of the workmen's houses as close to the plants as possible and the above mentioned and outstanding feature of lack of space.

The tramcars at Newcastle are operated by steam power. Certainly there are more comfortable and noiseless methods of traveling from place to place. There are no signs of rapidity about this transit system, the speed being about eight miles per hour.

Such losses as are sustained on passenger traffic, both surface and standard, are made up from general taxation and do not bear particularly hard upon the voter, who individually is not a large taxpayer, but are borne by manufacturers and business men. In all the policies of the Government the voter is catered to at the expense of the resources of the country, and as is commonly the case in Australia and elsewhere, the bright feature of cheaper fare on standard long distance journeys is seen, while the necessary additions to the prices of commodities involved by the extra taxation is lost sight of.

Workers' Children to Be Cared for by Employers

Since the writer left Australia the New South Wales Parliament convened and, as illustrating still further the feature of catering to the labor voter, I have noticed the following Associated Press cable:

SYDNEY, N. S. W., Oct. 30.—A fixed amount covering the cost of living for a man and his wife and the maintenance of their children is to form the basis from which wage rates will be calculated in New South Wales. A bill embodying this novel scheme for ending the "vicious circle" of increasing living costs and raised wages has passed the legislative assembly. The scale of living costs is to be formulated by the Board of Trade after an inquiry. The maintenance of children of workers will be met by payments from a fund administered by the Government. Employees receiving not more than $1.25 above the declared living wage will be paid the full amount ascertained to be the cost of maintaining each child.

The fund is to be established by monthly payments from employers, each employer paying in proportion to his average daily number of employees. No payments are due for the children of employees on a strike. The bill will apply to practically all employees in the state whose earnings do not exceed $2,000 annually.

This legislation was being agitated during the eight months of the writer's sojourn in Australia. Surely paternalism could go but very little further.

Seamen's Strike Shuts Down Steel Works

Notwithstanding the fact that the labor party instituted the Commonwealth Court of Conciliation and Arbitration, the unions do not always consider themselves bound to obey its behests, always reserving the big stick of a strike as the last resort.

In April-May, 1919, the Seamen's Union made demands upon the ship owners for increased pay, 35s. per month, and better living conditions, including a 6-hr. day in port and one complete day in each fortnight on full pay. These demands were refused, and a strike was ordered, the union refusing to submit to the award of its own court. The strike lasted 15 weeks, tying up all coastwise shipping and paralyzing mining, steel and kindred industries. It was eventually settled on a compromise basis, but not without leaving scars which will take a long time to heal.

The Seamen's Union recked little of the results to the commonwealth at large or even to its own fellow unionists. The Broken Hill Proprietary Co.'s plant had to shut down for lack of ore. The miners could not work for lack of shipping. Carpenters, masons, stevedores, all unionists, could not obtain supplies except in scant quantities. The people suffered a sugar famine, with sugar waiting in the next state for shipment, and the whole industry of the commonwealth was crippled for nearly one-half of a year. And although the strike was called off on Aug. 24, 1919, the normal condition is not reached yet.

There is a strong I. W. W. movement in the commonwealth among the semi-skilled unionists. They call their propaganda the One Big Union. This is making quite considerable headway among the miners, who have always been restless and ready to strike at a moment's notice, whether there was any reason or not.

The skilled trades, artisans, mechanics and others, are not so prone to be led astray by this mischievous doctrine, but there is still a feeling of unrest and insecurity even among this class.

Steel Mill Equipment Hard to Obtain

Another great handicap to steel manufacture existing and to be established within the commonwealth is the dearth of facilities for heavy machine work, either for repairs or for new machinery. At the time the writer was in Australia it was impossible to procure heavy housings, etc., from either England or the United States, so designs were prepared with the idea of obtaining the necessary plant in Australia.

It was found impossible, however, to obtain propositions from any firm who could undertake the whole contract in anything like a reasonable time, and to subdivide is never a wise course if it can be avoided. The prices asked by the firms who were able to bid on portions of the work were higher by 10 per cent than the cost of similar plant made in America at the highest war level, plus duty, freight and insurance.

This condition, however, is being ameliorated by some of the more progressive firms, notably A. Goninan & Co. of Newcastle, Morts Dock Co. of Sydney and the Clyde Engineering Co., Sydney. A. Goninan & Co. had already machined a 40-ton housing for the Broken Hill Proprietary Co., Ltd., on a V. & H. planer of their own manufacture and had several heavy tools on the way from England due to arrive at the end of 1919.

Naval Work for 1920

A letter from Secretary of the Navy Daniels to the clerk of the Massachusetts Senate in reply to an order by that body enquiring as to the report that curtailment in the Navy's building program at the Charlestown Navy Yard was contemplated throws an interesting light on prospective work for 1920 at that and similar yards.

The letter states that the Navy Department has no intention of discontinuing work at the Charlestown yard, or at any other yard, except where during the war or since then a large surplus has accumulated, or Congress has reduced the appropriation to a point which makes curtailment necessary. The appropriations for the fiscal year 1920 were cut from $18,000,000, Mr. Daniels' recommendation, to $9,000,000, and work at all yards, in his opinion, necessarily will be very much curtailed. The letter states, however, that Mr. Daniels has just ordered another vessel built at Charlestown.

Mr. Daniels says that since June, 1917, the Government has completed 63 destroyers at Quincy and Squantum, with eight remaining uncompleted there, and that the total cost of direct labor on these vessels was $30,473,149.

Group Insurance for 70,000

The General Electric Co. has announced the adoption of a group insurance plan for all employees who have been with the company for a year at any of its plants. The plan will affect 70,000 workers of both sexes. The total liability which will be assumed by the company will be $50,000,000, it is estimated. The plan went into effect Jan. 1.

Welding Cast Iron With the Electric Arc

How to Overcome Brittleness and Cracking —The Technique Necessary to Success— Typical Illustrations of Welding Methods

BY OTIS ALLEN KENYON*

PERUSAL of many recent articles on arc welding discloses the fact that most engineers are under the impression that cast-iron welding with the electric arc is something new, that first came to light when the German ships were repaired. Those who have used arc welding for the last five or ten years of course know better, but for the benefit of those who have only lately taken up the study and use of arc welding it might be of interest to know that welding cast iron is about as old as the art, and that the success of this kind of work depends more upon the skill of the welder than upon the type of machine that is used.

There are many difficulties to be overcome in the welding of cast iron. It is impossible to make a simple classification of these difficulties as far as doing the work is concerned, but for purposes of

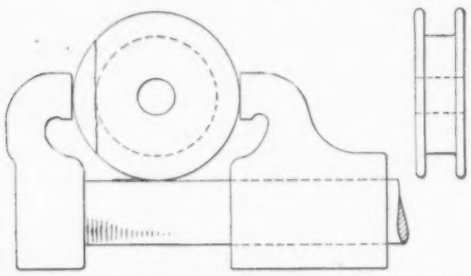


Fig. 1—Clamping a Cast-Iron Pulley Preparatory to Welding. This is the most accurate method of assembling the broken parts, providing the break is not shattered

discussion it is practically necessary. To facilitate the study of this class of welding it is convenient to divide the troubles encountered into three general groups, namely:

1. Brittleness of the metal in the weld along the line of fusion between the deposited metal and the original casting.
2—Cracking due to the shrinkage of the deposited metal.
3.—Cracking due to contraction of the parts welded.

Of course these three phenomena are inter-

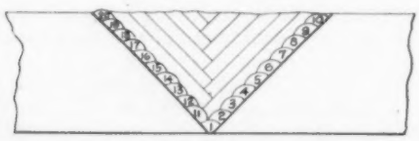


Fig. 2—Diagrammatic Sketch of a Massive Joint. The order in which the layers of welding material have been deposited is shown by the sequence of the numbers

related and often combined in various ways, but to avoid complexity in the discussion we shall endeavor to treat them separately.

It is well known that metal melted in the electric arc by the metallic electrode process is deprived of practically all its carbon by its passage through the arc. Therefore, when this molten carbonless metal comes into contact with the cast iron it absorbs carbon, forming a layer of high carbon steel at this point.

In many cases the casting is of such mass that its heat-conducting power is sufficient to chill suddenly the deposited metal, producing an extremely brittle structure. When a weld of this kind is subjected to strains due to the shrinkage of the weld itself or the distortion of the casting, a break will occur following the line of fusion between the casting and the weld. This difficulty can never be completely eliminated except by preheating and slow cooling. However, it can be rendered negligible in many cases by burning out the weld with a metallic arc electrode.

The best way to understand the burning-out process, perhaps, would be to give a description of a definite job. Therefore we will take the case of

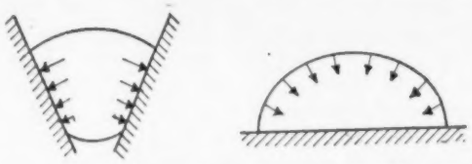


Fig. 3—A String of Metal Fused on Two Sides Contracts and Generates a Strain on Two Sides; When Fused on One Side, as in Fig. 2, No strain is produced

a grooved pulley, one rim of which was broken off as shown in Fig. 1. Since cast iron breaks without appreciable distortion, the most accurate method of assembling the broken parts, providing the break is not shattered, is to replace them without disturbing the surface of the break and clamp them together. In this case the pulley was clamped as shown. The voltage limit on the arc was increased to 45 volts, and the current was reduced to 80

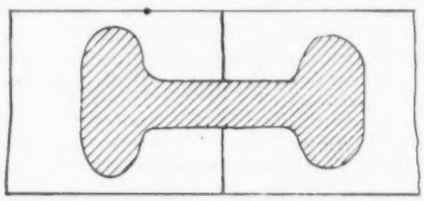


Fig. 4—Method for Welding the Frame of a Punch Press. The joint is produced by cutting grooves in the cast iron, and then filling them with steel

amperes. Beginning at the outside edge, the arc was played on the fracture and the groove burned through for about one-third of the length of the break. Then the operator returned to the open end of the groove and deposited a sufficient amount of metal to hold the position of the parts at the outside end. He then continued the burning through for another third when he welded a spot in the middle. Having welded two spots to hold the relative position of the parts, he burned on through to

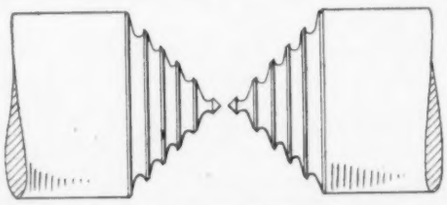


Fig. 5—Repairing a Cast-Iron Shaft. Grooves are cut in each side of the joint, and then filled with steel by the arc process. This is the same principle as applied in Fig. 4

the end and put in a spot there. Then without delay, and while the parts were hot, he filled in the groove as rapidly as possible, using 120 amperes.

The technique of this operation is the most difficult part—that is, being able to use the same arc and the same welding pencil and the same current

*Ray D. Lillibridge, Inc., 111 Broadway, New York.

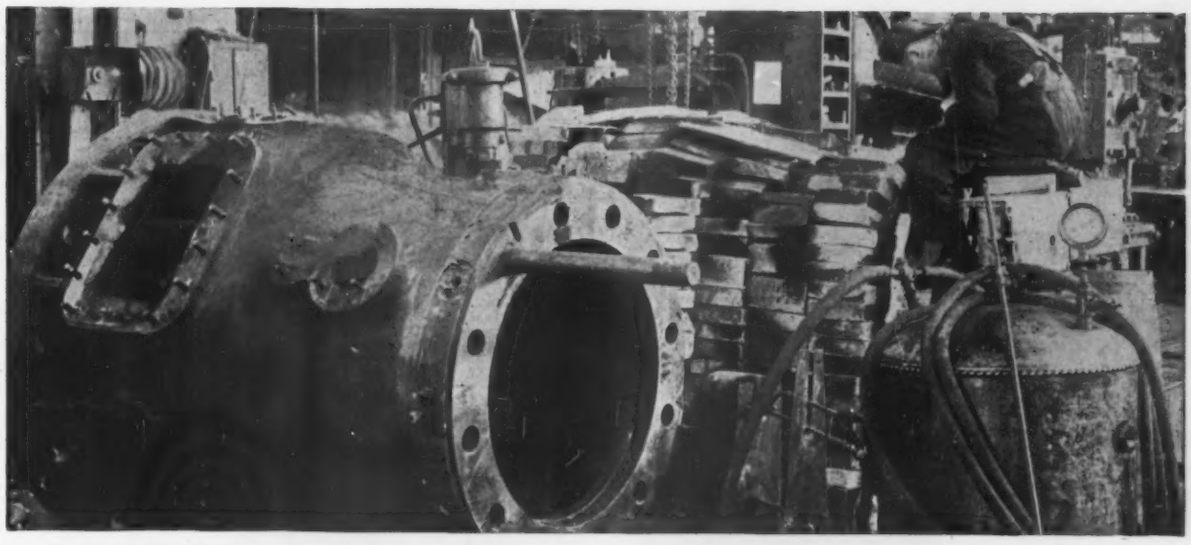


Fig. 6—Repairing a Cracked Cylinder. After enclosing with fire brick, a blow torch was applied to warm the cylinder

for cutting or welding as desired. In order to cut, the welder holds the arc as long as he can with the work and the arc in such a position that the metal will tend to run, and the moment a drop of metal forms in the weld the arc is played on that drop, burning it up, and in this way by carefully watching the action of the arc and playing it on the hottest parts of the weld, metal can be removed as desired. When the operator desires to weld he shortens his arc as much as possible and avoids playing it on the hottest points. Then when he is ready to complete the joint he uses a higher current and a lower voltage limit and deposits the metal as rapidly as he can.

This method, in addition to decreasing the labor of assembly and increasing the accuracy of the result, has the advantage of burning out the carbon in the casting adjacent to the weld, and the burning out process heats the metal locally so that when the weld is made, not only is there very much less absorption of carbon at the fusion line, but the quenching effect of cold iron is also very much reduced. It is safe to say that wherever the casting is not too heavy or so located as to prevent the burning out with a metal pencil, the difficulty of brittle metal can be practically eliminated. In cases of blow holes or very heavy castings which cannot be moved around or manipulated in such a way as to permit burning with a metal pencil, the welding conditions can be greatly improved by burning out with a carbon pencil. This removes some of the carbon from the casting and also heats up locally the surfaces to be welded.

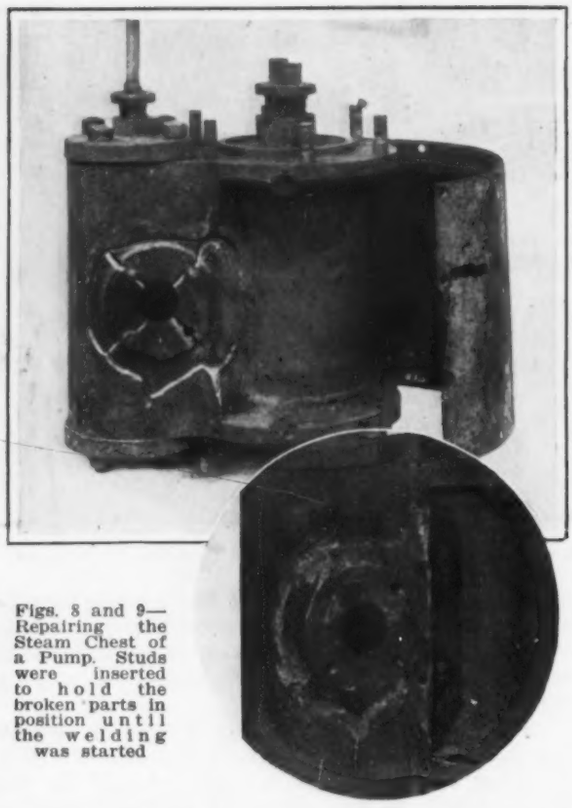
Cracks due to shrinkage of the deposited metal may result from a combination of brittleness and shrinkage strains, or they may result from shrinkage strains alone, as even the best welding of cast iron is very hard. Shrinkage strains in light castings are more difficult to avoid than in large ones. In small castings the only really satisfactory way to avoid shrinkage strains is to heat the metal sufficiently to permit their absorption in the parts welded. This will take care of itself if the burning out process is employed.

There are two ways known to the author of welding cast-iron joints so as to avoid difficulties due to shrinkage: One is to deposit the metal so that strains cannot occur and the other is to remove the strains as the welding progresses. In Fig. 2 is shown a diagrammatic section of a massive joint, the order in which the layers of welding material have been deposited being shown by the sequence of numbers. The surface of the casting can be treated with the carbon arc providing porousness is not objectionable. However, it is difficult to make a leak-proof weld on a surface over which a carbon arc has been played.

The theory upon which this method of depositing the strings of metal is based is shown in Fig. 3. A string of metal deposited as shown at the left is fused fast on two sides and in its attempt to contract generates a strain between these two sides. In the sketch at the right the string of metal is fused on one side only and therefore encounters no opposition to contraction, and consequently no strain is produced. By building up a layer of strings on one side of the joint, each string is permitted to contract without strain, then by building up layers alternately on one side and the other the joint is gradually filled up with new metal, each string of which is permitted to contract without strain.

Another method of doing this sort of work is

Fig. 7—After Heating, as shown in Fig. 6, the Crack Was Opened and Welded. Then the torch was again applied to the bricks, and the cylinder allowed to cool slowly



Figs. 8 and 9—Repairing the Steam Chest of a Pump. Studs were inserted to hold the broken parts in position until the welding was started

to tap lightly with a sharp peening hammer on the welded metal as it is deposited; that is, after welding a short distance and while the metal is still red, tap it lightly with the hammer. This will release strains if properly done. However, there is a danger of destroying the metal by causing it to become brittle if the hammer blows are too hard. This method of welding and tapping with a hammer has also been successfully employed for welding cracks in locomotive boiler sheets that are so supported with stay bolts as not to permit of any appreciable distortion.

Still another way of relieving shrinkage strains which is applicable to relatively thin as well as massive castings, is to place a string of metal in the bottom of the crack and as soon as completed cut out at least half of it with an air chisel; then place another layer of metal and cut out half of it, repeating this operation until the space

Figs. 10 and 11—The Upper Break Was Repaired by Inserting a Cast Piece and Welding It on Both Sides. The lower break was filled with metal by the arc

forming the joint is completely filled. This method, while slow, is the best of all as far as quality is concerned, as in addition to removing the strains it also removes all the slag and permits an accurate inspection of every part of the weld. If there are any porous spots they will be closed up by the action of the chisel.

As far as troubles from expansion and contraction of the work itself are concerned, these are seldom encountered except in jobs where it is necessary to play the arc for considerable periods of time in the same place. Troubles resulting from this action can only be overcome by proper preheating and the methods of preheating are the same as those employed by gas welders, except that very much less heat is required for the arc process.

In case preheating is necessary, the welder must study the particular object he is welding and determine where strains will occur when the metal surrounding the weld expands and contracts. He also must estimate what stresses will be set up when he heats these places where strains are expected and sufficient heat must be applied in the different places where strains will occur to permit equalization of strains by expansion and contraction. In all cases of heating it is ever so much more important to carefully attend to the cooling than it is to the heating. The cooling must take

Figs. 12 and 13—The Frame of This Air Compressor Is Subjected to Severe Strains. Cracks that developed were successfully opened, filled and reinforced

place uniformly and over as long a period as possible.

Many times it is found more practicable to repair a casting by combining welding with some sort of a mechanical joint. This method requires very much less skill on the part of the welder and therefore is excellently adapted to many kinds of work. In fact, this method was very extensively used in the repairing of the German ships. One form of this type of weld is produced by inserting a row of steel studs along each side of the crack; then with a metal arc depositing metal around these studs and filling in the space between them and across the crack. In this way perfect fusion between the studs and the steel of the weld is easily obtained, the studs forming anchors which are easily able to withstand the shrinkage strains.

Figs. 14 and 15—Arc Weld Repairs on the Broken Rim of the Wildcat of an Anchor Windlass. The lugs are severely strained when the anchor is suddenly halted

After the welding is complete these strains can be largely removed with an air hammer on the cold metal, using a rough tool and peening the whole surface.

Still another form of this type of joint is produced by cutting grooves in the cast iron, and depositing steel in the grooves. This method as applied to the frame of a punch press is shown in Fig. 4. Here we see the welding material acting as a steel link between the two broken parts in which case the shrinkage of the steel only serves to tighten the joint and draw the two broken parts into place. There is sufficient fusion between the steel and the cast iron to hold the links in place, but we are not at all dependent on the fusion between the cast iron and the steel for the strength of the joint, but simply on the steel itself.

A clever method, devised by Howard Payne, of applying this same principle is shown in Fig. 5. In this instance a cast-iron shaft was repaired by cutting grooves in each side of the joint as shown. These grooves were then filled with steel by the metal arc process, which had the effect of shrinking a series of steel rings on each side, leaving a practically clear steel surface on each side of the joint. This accomplished, the welding proceeds in exactly the same way as though the shaft were made of steel.

As an indication of what can be accomplished in the way of welding cast iron and what has been accomplished for the last ten years in this line of work, a number of examples are shown herewith. Figs. 6 and 7 show the repair of a badly cracked Diesel engine cylinder. This repair was executed by enclosing the cylinder with fire brick, as shown in Fig. 6, and applying a powerful blow torch to the mass until the whole cylinder was warm. In this connection, it should be noted that the amount of preheating for electric arc welding is very much less than for oxyacetylene welding. For acetylene welding a cylinder must be brought up to a fairly high temperature, whereas with arc welding it need merely be warm. The crack having been opened, was then filled with welding material, as shown in Fig. 7. When completed the torch was again turned on to the mass of bricks, and the whole cylinder allowed to cool very slowly.

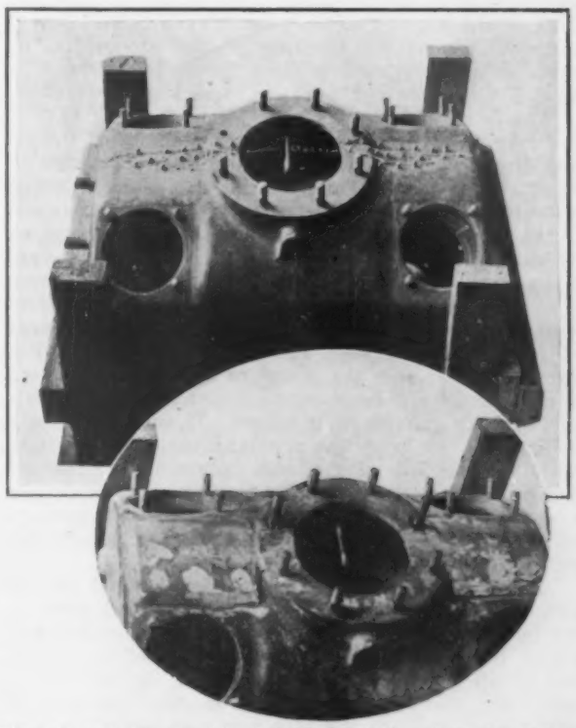
Figs. 8 and 9 show the repair of the steam chest of a pump. Sections of the chest around the steam intake were broken out entirely, and in order to hold them in position until the welding was started, it was necessary to insert studs, as shown in Fig. 8. This figure also shows how the joint was cleaned out and prepared for the introduction of the welding material. Fig. 9 shows the complete job cleaned off and ready for service.

Sometimes a break is so badly shattered that a repair can only be made by inserting a new casting or by filling the entire space with new material deposited by the arc. In Fig. 10 is shown a break of this kind and in Fig. 11 the repair is seen. The break at the top was repaired by inserting a cast piece and welding it on both sides; while the break at the bottom was entirely filled with metal deposited by the arc.

Many times welded parts are stronger than the original, due to the fact that casting strains have been relieved and the metal section reinforced at the weakest points.

As an example of this type of repair, the writer recalls a 100-ton ice machine which broke through all four main bearings when it was first started up, indicating that the machine failed due to structural weakness. The breaks were repaired by arc welding and the bearings reinforced by the same process. This was some six years ago and the machine is still running.

Fig. 12 shows the frame of an air compressor which is subjected to extraordinarily severe strains. This particular machine gave way in service, as shown by the cracks which have been chalked so as to render them visible. In repair, these cracks were opened up, filled and reinforced, as shown in Fig. 13, and the compressor frame is stronger than it was originally.



Figs. 16 and 17—Combination Mechanical and Fusion Joint. Stud bolts are inserted on both sides of the fracture

Fig. 14 shows the wildcat of an anchor windlass. In operation the links of the chain fit in a special groove in the wheel, forming a positive

connection between the wheel and the chain. The lugs seen near the periphery of the wheel engage with projections on a clutch, by means of which the anchor is halted whenever desired. If the clutch is thrown, as it is many times, while the anchor is in full descent, the wildcat is subjected to very severe strains. In the present instance such a strain resulted in the breaks shown. Fig. 15 shows the same wheel after having been repaired by arc welding.

An example of the use of a combination mechanical and fusion joint is shown in Figs. 16 and 17, which illustrate the repair of the high pressure cylinder of an air compressor. In Fig. 16 we see the fracture opened up and provided with stud-bolts inserted on both sides of the fractures, and staggered in relation to one another. Fig. 17 shows the same cylinder after the welding has been completed. As it may be seen, the weld extends about ½ in. above the original surface of the cylinder shell, thus furnishing a very considerable reinforcement.

Whitley Plan in Fifty British Industries

Organization Has Proceeded Slowly—Priestman Scheme of Co-operation Now Receives Much Attention—Attitude Friendly Toward Labor Unions

WASHINGTON, Dec. 29.—The organization of British industries according to the Whitley plan is progressing slowly. After more than two years of agitation, 50 industries have been organized according to this plan—the fiftieth was the cement industry.

The organization of the national council which was to effect the ultimate object of the plan has, however, made no progress. So far, the work has been limited to the establishment of national industrial councils for individual industries that have accepted the program, and the creation of trade boards in the industries in which either the employers or the employed were not sufficiently organized to make possible the complete acceptance of the Whitley plan. It depends for its effectiveness upon a thorough organization of both capital and labor in every industry. As a result of the slowness with which the Whitley plan has made headway, despite the activities of the British Ministry of Labor, attention is now being centered on the Priestman scheme of cooperation. This is not to take the place of the Whitley method, for it runs in an entirely different line, but by securing greater cooperation of employer and employed in the different industries it is playing an important part in increasing production.

This plan receives its name from the fact that it was originated by the engineering company of Priestman Brothers, Ltd., Hull, who put it into practice in April, 1917. Public interest in the plan is being fostered on the higher production aspect. The purpose of the Priestman scheme is to give to the workers an increase in wages for every increase over standard production. Priestman Brothers report that it has been a genuine success and has proved far more effective than the ordinary piece-work scale or the usual payment of production bonuses. The method is simple. For every increase over the standard in production, each worker receives a corresponding increase, by percentage, over his regular daily wages. If, during a month the output falls below the standard, the deficit must be made up the following month before the excess for that month is calculated. The men are represented by a works committee which meets with the management once a month to determine the exact production for the preceding month.

The original "standard output" was fixed by the men and the employers jointly. A cardinal point is the fact that the bonus goes, not to the individual employee, but equally to all of the members of the particular group which increased production. In the Priestman plant, these groups comprise founder, turner, pattern maker, molders, machine men and laborers.

Operation of the Whitley Plan

Concerning the operation of the Whitley plan, the Bureau of Labor Statistics has received detailed reports as to the organization of the national industry councils by 50 industries in Great Britain with a total of approximately 3,000,000 employees. These industries include iron and steel wire manufactures, with 34,000 employees; Welsh plate and sheet factories, with 25,000 employees and tin mines with 6,000 employees. Preliminary work, however, has been done in a long list of other industries including iron and steel foundries with 67,000 employees; other iron and steel industries with 216,000 employees; edge tools with 22,270 employees; tin plate, 17,705 employees; wrought and hollow ware, 33,000 employees and zinc and spelter, 3,145 employees.

The Whitley plan of industrial organization is by far the most thorough-going which has so far received Governmental sanction. It was worked out during the war by a Government committee headed by J. H. Whitley, chairman of the committee of the House of Commons. Its membership was made up of representatives of employers, labor unions and a considerable sprinkling of Governmental representatives. Despite the fact that the Government officially approves the plan, the committee has since complained concerning the delay in the organization of the Government departments themselves, although this has finally been accomplished. To the American manufacturer, the outstanding feature of the program is the stress laid upon labor unions.

Friends of the plan make no effort to conceal their conviction that it will ultimately lead to the complete unionization of every British industry.

The plan proposes a three-fold organization of industry—in the workshops, by districts and nationally. In each case the organization is to be made up of employers and employed—but instead of the "works" committee the organization is composed of representatives of the employers' association and the labor unions.

Alternative Suggestions

Because the extent of the actual organization in the various industries is widely divergent, the Whitley committee found it necessary to make alternative suggestions. For the industries in which both the employers and the employed were completely organized, it proposed an immediate organization of joint industrial councils consisting of the joint national industrial councils, the joint district councils and the works committees of each industry. Each of these three forms of organization was to be linked up with the others to constitute an organization covering the whole of the trade, and, in the words of the committee report, "capable of considering and advising upon matters affecting the welfare of the industry, and giving to labor a definite and enlarged share in the discussion of industrial matters in which employers and employed are jointly concerned."

In the industries, however, where the existing organizations did not function sufficiently to make this comprehensive plan possible, the committee program called for the institution of a system of trade boards which would ultimately be extended into the joint councils. To accomplish this, the Government was to appoint members of these boards until they would be able of their own standing to act independently.

A summary of the plan for the various industries follows:

For poorly organized industries, or poorly organized localities of an industry, there are trade boards, which are in the hands of the Ministry of Labor.

For moderately organized industries, or for industries which evince a somewhat lukewarm interest in the subject and need to have their patriotic feeling aroused, there are interim industrial reconstruction committees, fostered by the Ministry of Reconstruction.

For well-organized industries, where there is the full-fledged joint council, the scheme of which will probably continue to be credited to the Whitley committee, although that committee only crystallized an idea long thought of and considered.

In a survey of the results which have been attained, the report of the Bureau of Labor Statistics of our own Department of Labor says:

Results Attained

"It has been maintained by some that the Whitley plan is applicable primarily to the organized trades and cannot be readily adapted to the interests of the large army of unorganized workers. Moreover, a further objection to the Whitley scheme voiced by many is that it is essentially a Government plan and offers opportunity for the Government to exercise a sort of supervision of influence over the operation of the councils, whereas the workers demand an industrial self-government plan that will leave them free to control, together with the employers, all matters affecting their interests. This latter statement may explain to a degree the apparent slow movement toward setting up industrial councils. There has existed a disinclination on the part of workpeople to accept at face value propositions advanced by those in authority which seem to promise rather more than the workers believe possible. The constant strain under which the laboring class has been living on account of the war conditions has tended to engender suspicion and this, together with a lurking fear that pre-war union regulations may never be restored, has operated to fill the minds of workmen with apprehension and to make them reluctant to indorse the joint industrial council scheme. This attitude appears to have been aggravated by the hesitation of the Government to adopt the plan as a whole in any department. It cannot be said, on the other hand, that employers have shown a greater willingness to adopt the industrial council idea. Both sides have proceeded rather cautiously. If it has been possible for a firm to get along with its employees without friction, it has seemed to evince little desire to adopt any new methods; on the other side, if its employees in any locality are dissatisfied with their working conditions, they are apt to be greatly in favor of this chance for improving their position."

The Whitley committee itself outlined as the ultimate goal of each industry, "the establishment of an organization representative of employers and workpeople, to have as its object the regular consideration of matters affecting the progress and well-being of the trade from the point of view of all those engaged in it, so far as this is consistent with the general interest of the community, appears to us necessary."

Questions for the Councils

Among the questions to be handled by these councils, the committee outlined the following:

(1) The better utilization of the practical knowledge and experience of the workpeople.

(2) Means for securing to the workpeople a greater share in and responsibility for the determination and observance of the conditions under which their work is carried on.

(3) The settlement of the general principles governing the conditions of employment, including the methods of fixing, paying, and readjusting wages, having regard to the need for securing to the workpeople a share in the increased prosperity of the industry.

(4) The establishment of regular methods of negotiation for issues arising between employers and workpeople, with a view both to the prevention of differences and to their better adjustment when they appear.

(5) Means of insuring to the workpeople the greatest possible security of earnings and employment, without undue restriction upon change of occupation or employer.

(6) Methods of fixing and adjusting earnings, piecework prices, etc., and of dealing with the many difficulties which arise with regard to the method and amount of payment apart from the fixing of general standard rates, which are already covered by paragraph (3).

(7) Technical education and training.

(8) Industrial research and the full utilization of its results.

(9) The provision of facilities for the full consideration and utilization of inventions and improvements designed by workpeople, and for the adequate safeguarding of the rights of the designers of such improvements.

(10) Improvements of processes, machinery, and organization and appropriate questions relating to management and the examination of industrial experiments, with special reference to co-operation in carrying new ideas into effect and full consideration of the workpeople's point of view in relation to them.

(11) Proposed legislation affecting the industry.

The Individual Trades

The committee recognized, however, that in dealing with these problems the greatest possible leeway should be left to the individual trades, "it being understood that it is essential to secure in each industry the fullest measure of co-operation between employers and employed, both generally, through the national councils, and specifically, through district committees and workshop committees."

In the light of our own experience and with the disregard of public interests shown in the steel and coal strikes, a paragraph on this subject from the Whitley report is of interest. It follows:

"It has been suggested that means must be devised to safeguard the interests of the community against possible action of an anti-social character on the part of the councils. We have, however, here assumed that the councils, in their work of promoting the interests of their own industries, will have regard for the national interest. If they fulfill their functions, they will be the best builders of national prosperity. The State never parts with its inherent overriding power, but such power may be least needed when least obtruded."

The Whitley committee carefully refrained from touching upon the problems of profit sharing, copartnership and the various wage systems. It put on record its conviction, however, "that the permanent improvement in the relations between employers and employed must be founded on something other than a cash basis." It declared that "what is wanted is that the work-people shall have a greater opportunity for participating in and the adjustment of industry by which they are most affected."

In a supplemental report, however, the committee described at length the operation of the works committees. It pointed out that the chief aim of such a committee should be to secure a greater co-operation between the employers and the employed. In this, it again laid stress upon the necessity for thorough organization, declaring "that the complete success of works committees necessarily depends largely upon the degree and efficiency of the organization in the trade." Here again it emphasizes its solicitude for the labor union.

Favors Trade Unions

"We think it important to state," says this report, "that the success of the works committees would be very seriously interfered with if the idea existed that such committees were used, or likely to be used, by employers in opposition to trade-unionism. It is strongly felt that the setting up of works committees without the co-operation of the trade-unions and the employers' associations in the trade or branch of trade concerned would stand in the way of the improved industrial relationships which in these reports we are endeavoring to further.

"In an industry where the work-people are unorganized, or only very partially organized, there is a danger that works committees may be used, or thought to be used, in opposition to trade-unionism. It is important that such fears should be guarded against in the initiation of any scheme. We look upon successful works committees as the broad base of the industrial structure which we have recommended, and as the means of enlisting the interest of the workers in the success both of the industry to which they are attached and of the workshop or factory where so much of their life is spent. These committees should not, in constitution or methods of working, discourage trade organizations."

Concerning the operation of these bodies, the report says: "Works committees, in our opinion, should have regular meetings at fixed times, and, as a general rule, not less frequently than once a fortnight. They should always keep in the forefront the idea of constructive co-operation in the improvement of the industry to which they belong. Suggestions of all kinds tending

to improvements should be frankly welcomed and freely discussed. Practical proposals should be examined from all points of view. There is an undeveloped asset of constructive ability, valuable alike to the industry and to the State—awaiting means of realization; problems, old and new, will find their solution in a frank partnership of knowledge, experience and good-will. Works committees would fail in their main purpose if they existed only to smooth over grievances."

Conciliation and Arbitration

The Whitley committee also made a report on methods of conciliation and arbitration in industrial disputes. It declared that it is opposed to any system of compulsory arbitration and declared that the war experience with this method had demonstrated that it was not a successful method of fighting strikes even during the war, and in normal times it would undoubtedly prove even less successful. It also refused to sanction a plan to forbid strikes or lockouts pending inquiry. The report merely favored the expansion of the voluntary machinery for the adjustment of disputes.

"Where the parties are unable to adjust their differences," says the report, "we think there should be means by which an independent inquiry may be made into the facts and circumstances of a dispute, and an authoritative pronouncement made thereon, though we do not think there should be any compulsory power of delaying strikes and lockouts; we further recommend that there should be established a standing arbitration council for cases where the parties wish to refer any dispute to arbitration, though it is desirable that suitable single arbitrators should be available where the parties so desire."

Concerning the attempt to enforce awards and agreements by means of mandatory or other penalties, the committee declares its belief that "where it is to the interest of both employers and work-people and the community generally that industrial agreements should be duly fulfilled, in the long run this object is more likely to be secured by an increased regard for moral obligation, respect for an instructed public opinion and reliance on the principles of mutual consent rather than on a system of monetary penalties." O. F. S.

New Steel Plant Being Built in India

Ore and Coal Properties Acquired—Plans Call for Six Blast Furnaces, Coke Plant, Open-Hearth Furnaces and Rolling Mills

THE development of the iron and steel-producing industry in the Far East has made large strides during the past decade and that this progress is not at a standstill is evidenced by the recent entrance of a new company into the iron-producing field of India. The Indian Iron & Steel Co., Ltd., of Calcutta, India, with Burn & Co. as managing agents, was formed in the early months of 1918, for the purpose of utilizing iron ore and coal properties which had been prospected and acquired. These properties showed such promise that it was decided to build the first unit of a complete steel plant at Asansol, India, a town located on the East India Railway about 120 miles north of Calcutta. This location was chosen on account of its proximity to the coal fields.

Under the managing directorship of G. H. Fairhurst, preliminary work was completed and contracts were entered into for the construction of one complete 350-ton capacity blast furnace together with a 168-oven by-product coke plant. Simon-Carves, Ltd., of England, received the contract for the construction of the coke plant and Arthur G. McKee & Co., Cleveland, were selected as engineers and contractors for the construction of the blast furnace plant. The work of designing was started during March, 1919, and shipments of materials were started during April. At the date of this writing approximately 85 per cent of the materials of construction have been started overseas and the balance will probably be on shipboard before the end of the year.

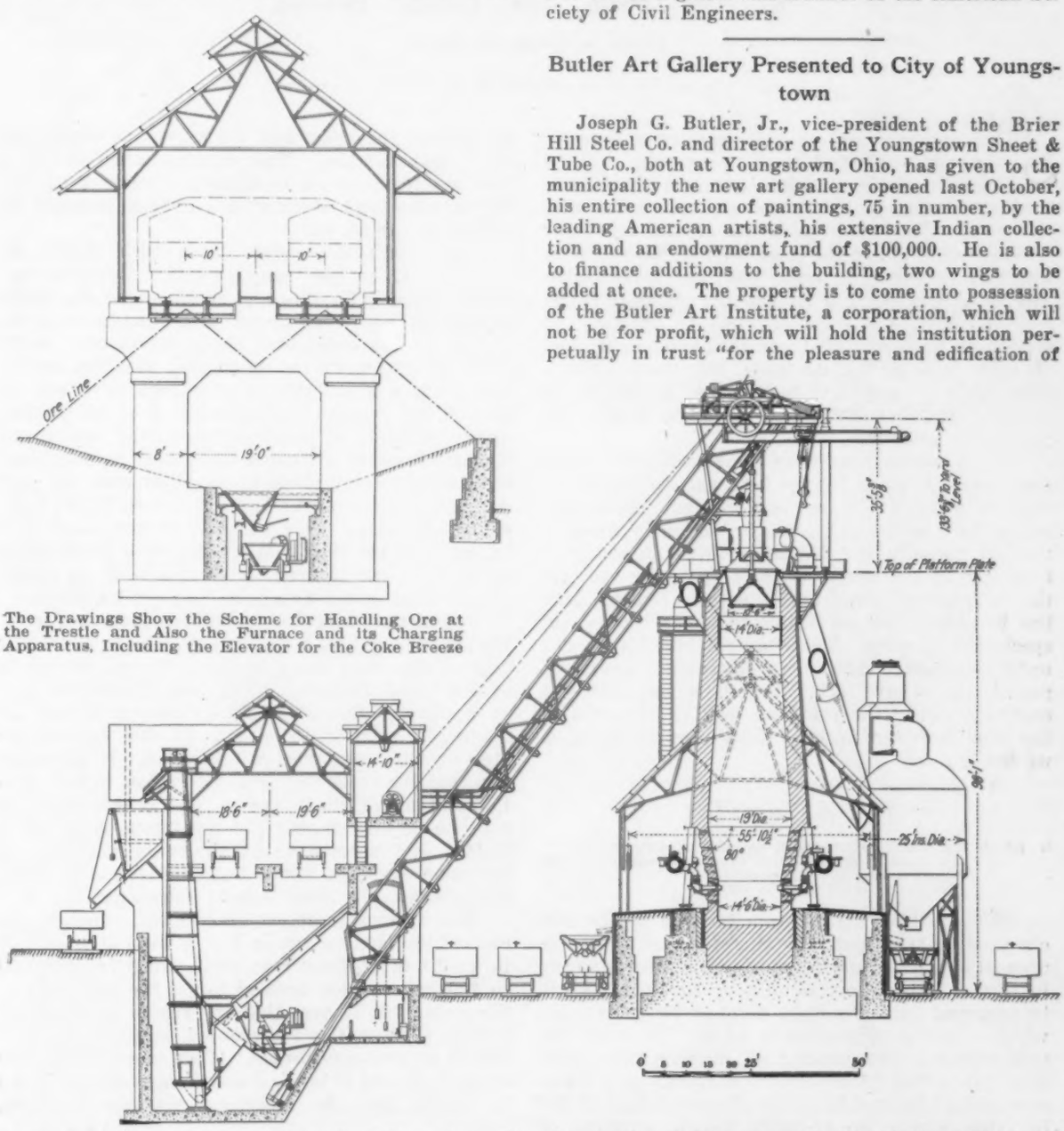
During September of the present year the Indian Iron & Steel Co. decided to further increase its capacity, and accordingly orders were issued to proceed with the construction of a second blast furnace of similar design to the first. The layout of the completed plant provides for the ultimate installation of six blast furnaces, each of 350 to 400 tons capacity, sufficient coke plant capacity to provide fuel for these furnaces and the addition later on of open-hearth furnaces and rolling mills to finish all the iron produced in the blast furnaces.

The blast furnace plant consists of a blast furnace 85 feet high, having a hearth fourteen feet in diameter and a bosh 19 feet in diameter. The furnaces are arranged in pairs, each pair having a common cast house. The product of the furnace is to be disposed of in ladles, Dewhurst cinder cars being provided for the slag and short-pour Pollack ladles of 75-ton capacity for the iron. Due to the amount of ore available suitable for the making of ferromanganese, extra large stove capacity is provided, the installation consisting of five hot blast stoves 25 feet in diameter and 95 feet high. The stove linings are of the side-combustion type laid up with standard 9-in. brick. All brick linings for stoves and furnaces are manufactured in India with the exception of the furnace hearth and bosh brick, these being supplied from America. In addition to a dust catcher, two centrifugal type dust separators are to be installed, provision being made to later install a dry dust-cleaning system.

The skip bridge, hoist engine and arrangement of the bell-operating mechanism is of standard design and construction according to the best American practice. One of the accompanying drawings shows a section through the central discharge type of coke bin as well as the arrangement of the coke screens and the coke breeze elevator and bins. For distributing of the furnace charge there is provided a McKee patented revolving stock distributor.

Due to the local topographical conditions the tunnel system for handling the ore from the trestle to the skip cars was used. The ore and limestone bin and storage system consists of a concrete trestle, and a tunnel for the scale car runs the entire length of this trestle. The roof of the tunnel consists of a series of unit bin bottoms each provided with a series of continuous segmental type gates arranged for hand operation from the scale car platform. This arrangement provides a continuous line of gates so that practically all the ore and stone held in storage under the trestle is available at the gates for discharge into the scale cars. The entire stock trestle is double tracked, and on account of the heavy rains at certain seasons it is covered with a steel roof structure.

The equipment includes two blowers of the Parsons type of 45,000-cu. ft. per min. capacity and 3500-hp. British B. & W. type boilers. The boilers and blowers are to be operated with steam at 200 lb. pressure with 100 deg. superheat. They were furnished from England. For handling the hot metal two double-strand pig-casting machines are



The Drawings Show the Scheme for Handling Ore at the Trestle and Also the Furnace and its Charging Apparatus, Including the Elevator for the Coke Breeze

to be installed, equipped with ladle tilting rigs. It is expected that the first furnace will be placed in operation during the latter part of 1920.

British Chamber of Commerce Organized in New York

The British Chamber of Commerce in the United States, recently incorporated, is located at 295 Broadway, New York. According to the constitution of the organization, its object is to encourage trade between the United States and the British Empire, give statistical information related to shipping, trading and manufacture, undertake to arbitrate in disputes of a commercial nature, promote British trade in the United States and furnish confidential information respecting the standing of firms and individuals in the United States and the United Kingdom.

Associate membership is open to all firms or individuals connected with firms in the United States, but officers and members of the board of directors are British subjects. Since the opening of the chamber's executive offices in December, 100 companies have become members. The board of officers consists of: President, Sir Charles Carrick Allom, White Allom & Co.; Vice-president, A. Walpole Craigie, Craigie & Co., Ltd.; Secretary and Treasurer, J. H. H. Muirhead, civil and mechanical engineer and member of the American Society of Civil Engineers.

Butler Art Gallery Presented to City of Youngstown

Joseph G. Butler, Jr., vice-president of the Brier Hill Steel Co. and director of the Youngstown Sheet & Tube Co., both at Youngstown, Ohio, has given to the municipality the new art gallery opened last October, his entire collection of paintings, 75 in number, by the leading American artists, his extensive Indian collection and an endowment fund of $100,000. He is also to finance additions to the building, two wings to be added at once. The property is to come into possession of the Butler Art Institute, a corporation, which will not be for profit, which will hold the institution perpetually in trust "for the pleasure and edification of the people of Youngstown." Mr. Butler will be the first president of the corporation and associated with him as incorporators will be his son, Henry A. Butler, his nephew, John W. Ford, John Stambaugh, former treasurer of the Brier Hill Steel Co., and Jonathan Warner, president of the Trumbull Steel Co., Warren, Ohio. With additions and endowment the institution will represent an investment of nearly $500,000.

New Firth-Sterling Warehouse

The Firth-Sterling Steel Co., whose New England headquarters have been at 35 Oliver Street, Boston, for a generation, will move during the month of January, the Oliver Street property with others adjoining having been purchased by the Federal Reserve Bank as a site for its building.

After Feb. 1 the Firth-Sterling Steel Co. will occupy its new warehouse at 85-91 West First Street, South Boston, where it will carry complete stocks of blue chip high speed and other Firth-Sterling tool and die steels.

Charts for Testing Steel and Steel Wire

Tensile Strength and Reduction in Area Quickly Determined—How Constructed to Any Scale and Limits Desired

(With Supplemental Plate)

BY H. M. BRAYTON, M. E.*

SOME laboratories in this country run many thousands of steel tests every year. These include tensile strength, per cent elongation, hardness, twisting, brittleness and numerous special tests. The tensile strength is the test most often resorted to and the calculation of the test data which is necessary in order that the information may be expressed in a logical and understandable form is often a routine and tedious process. It sometimes happens that these data must be worked up with considerable accuracy, but more often a little variation does not matter and in this latter case the graphical chart may be made to play the part of time saver.

In any tensile test there are two factors which must be determined by the test, namely, the minimum diameter of the test specimen and the load at which the piece breaks. It is, of course, customary to also measure the diameter of the piece after breaking at the breaking point in order to get the reduction of area. Let us assume that we have the breaking load and diameter of a number of specimens of wire. These are of but little value until transferred into terms of tensile strength in pounds per square inch. This is accomplished by merely dividing the breaking load by the area of the wire in square inches. Expressed by formula, we have:

$$S = \frac{L}{A} = \frac{L}{0.785\,D^2}$$

in which S = Tensile strength in pounds per square inch.
A = Area of cross section of wire in square inches.
L = Breaking load in pounds.
D = Diameter of wire in inches.

This equation represents a formula of the simple product type and may therefore be nicely expressed by a graphical chart. Such a chart is shown in Fig. 1. This chart is built up for wire, as will be apparent from the right hand or diameter scale, which is only graduated up to 0.1 in. The cross line will represent the method of reading this chart. The illustration taken shows a wire having a diameter of 0.08 in. and breaking at a dead load of 500 lb., thus giving an ultimate tensile strength of 100,000 lb. per sq. in. A rule or straight edge is all that is needed to read this scale, and a set of values can be read off very quickly and with good accuracy. The accuracy will depend, of course, upon the size of the chart and the number of subdivisions. Any one of the three variables represented may be solved for, if occasion requires, in exactly the same manner. Any two being known the third may be determined by a straight line across the chart.

It was not found practical to build a chart with a long range of the variable D. Sizes above 0.1 in. in diameter, such as are met with in ordinary steel testing work, must then be shown on another chart. Fig. 2 shows a chart built up for these higher limits of D and along the same lines as the chart in Fig. 1. The limits of all the variables may be seen on the chart and the cross line illustrates the manner of use. The example taken shows a steel specimen 0.8 in. in diameter breaking at 25,000 lb. dead load which gives a tensile strength of 50,000 lb. per sq. in.

The conditions under which such charts as shown could be used vary greatly. Some laboratories deal only in wire and small specimens, while others deal with even larger sizes than those given in Fig. 2. In order that these charts may be of the greatest possible value to steel men the writer believes it worth while to give here as briefly as possible the theory of these charts in so far as that theory is required in construction and enough of the mathematics to enable the reader to construct these charts for himself at whatever scale he may desire, and at whatever limits may best fit his individual situation. This will also enable the reader to construct the charts on tracing cloth from which as many prints as may be desired may be made. Theory that is not necessary will not be given.

Let us now refer to the chart given in Fig. 1. We have to start with the formula which we wish to chart. The first thing to do is to set the limits of the three variables. Practice determines this. It is obvious that it would be absurd to set the maximum value of S at say 600,000 because no steel or wire ever reaches this value. It may happen that the reader never has occasion to test steel higher than 80,000 lb. per sq. in. If this were the case he would set for the maximum value of S 80,000, and proceed to fix the other variables in the same manner. Really but two need to be fixed, because then the third follows automatically.

When these limits are determined, which in the case of the chart given in Fig. 1 were D from 0.01 in. to 0.1 in., L from 0 to 1000, and S from 20,000 to 400,000, we next proceed to get the equations of the scales. It is here that the reader must accept certain mathematics for granted, as space does not permit unnecessary proofs. If we express the three scales L, D and S by X, Y and Z respectively it can be shown that the following relations are true,

$$X = m_1 L,\ Y = m_2 D^2,\ Z = \frac{K m_1\, 0.785\, S}{m_1\, 0.785\, S + m_2}$$

In these equations m_1 and m_2 are constants and known as the modulæ of the scales. K is also a constant which represents the length of the diagonal. Refer now to Fig. 3. This sketch shows how to construct the chart. Draw two parallel lines any convenient distance apart. Across these lines draw a diagonal as shown at any desired angle. The length K is shown. This is the actual length of the line A-B in inches. These two parallel and one diagonal line should be proportioned according to the equations as will be shown below in order to make a good looking and practical chart. The theory holds true, however, no matter what the angle between the diagonal and the sides.

Along each one of these lines we must lay out a scale according to its equation. The value of this

*107 Elk Street, Syracuse, N. Y.

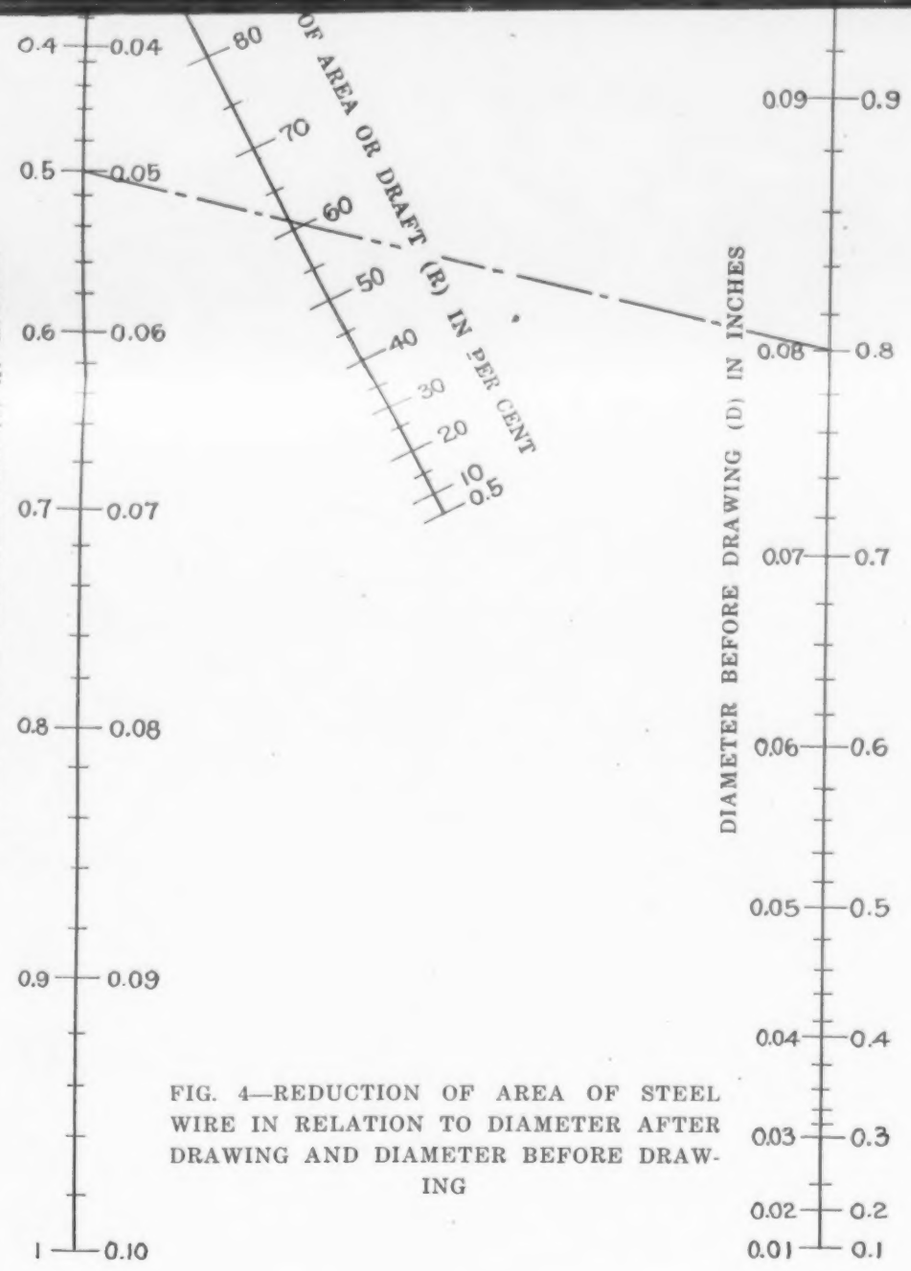


FIG. 4—REDUCTION OF AREA OF STEEL WIRE IN RELATION TO DIAMETER AFTER DRAWING AND DIAMETER BEFORE DRAWING

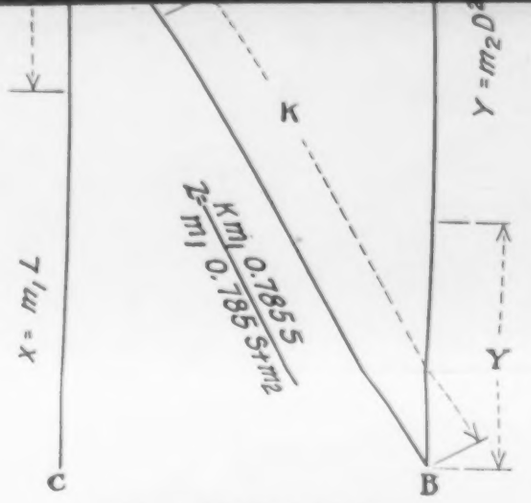


FIG. 3—METHOD OF CONSTRUCTING CHARTS FOR TENSILE STRENGTH OF STEEL

Charts for Testing Steel and Steel Wire

In testing steel wire or steel specimens the minimum diameter of the wire or test specimen and the load at which it breaks are determined. With these two factors known, the third, the tensile strength in pounds per sq. in., can be readily determined from Figs. 1 and 2. The cross line represents the method of reading the chart; for instance, in Fig. 1 by using a straight edge represented by the dotted line, a wire of 0.08 in. diameter, with a breaking load of 500 lb., is shown to have an ultimate tensile strength of 100,000 lb. per sq. in.

It is customary also to measure the diameter of the piece after breaking at the breaking point, in order to determine the reduction of area. Fig. 4 gives the reduction of area when the original area and reduction in area are known.

Fig. 3 is for use in constructing charts when the scales or limits of the variables as used in Figs. 1, 2 and 4 do not cover the requirements.

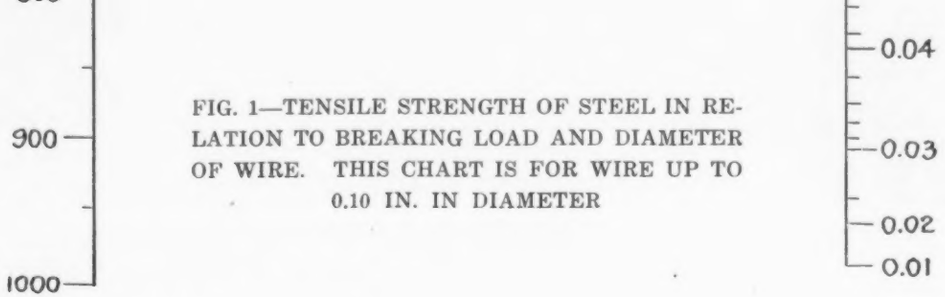


FIG. 1—TENSILE STRENGTH OF STEEL IN RELATION TO BREAKING LOAD AND DIAMETER OF WIRE. THIS CHART IS FOR WIRE UP TO 0.10 IN. IN DIAMETER

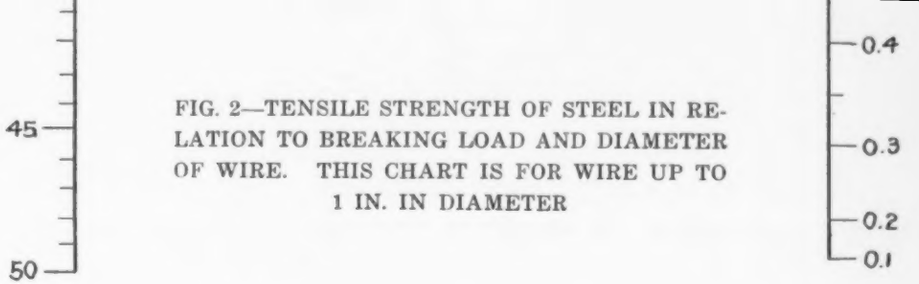
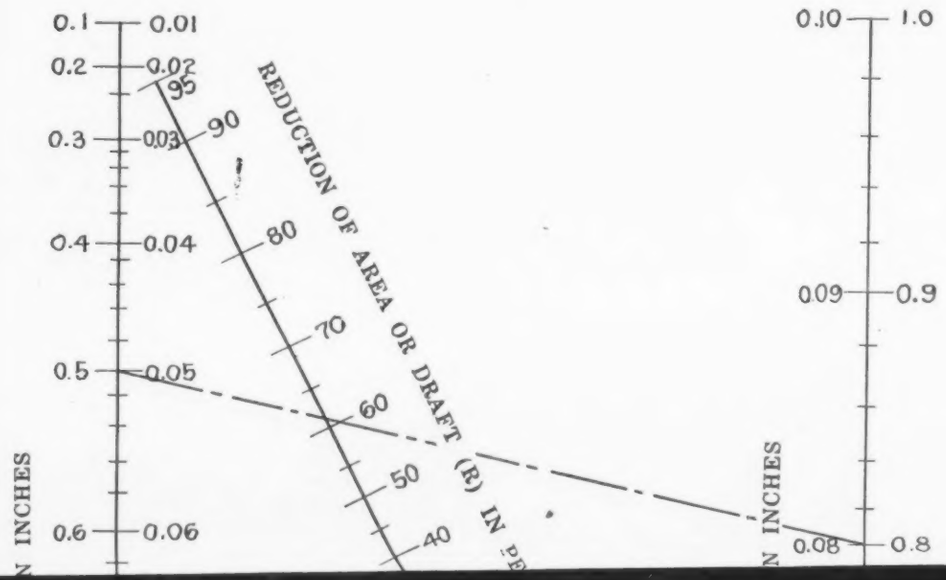
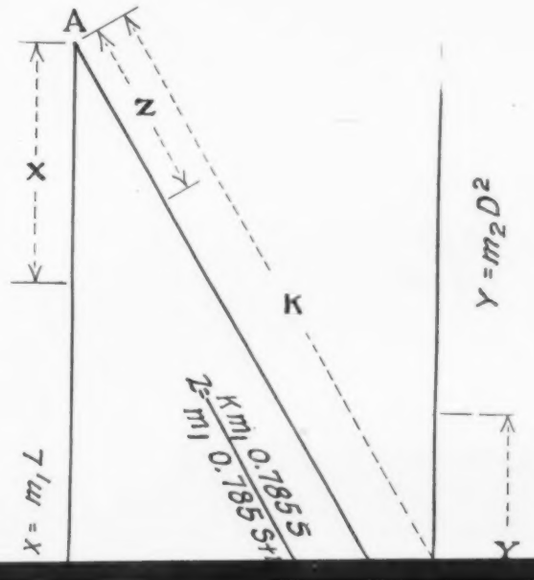
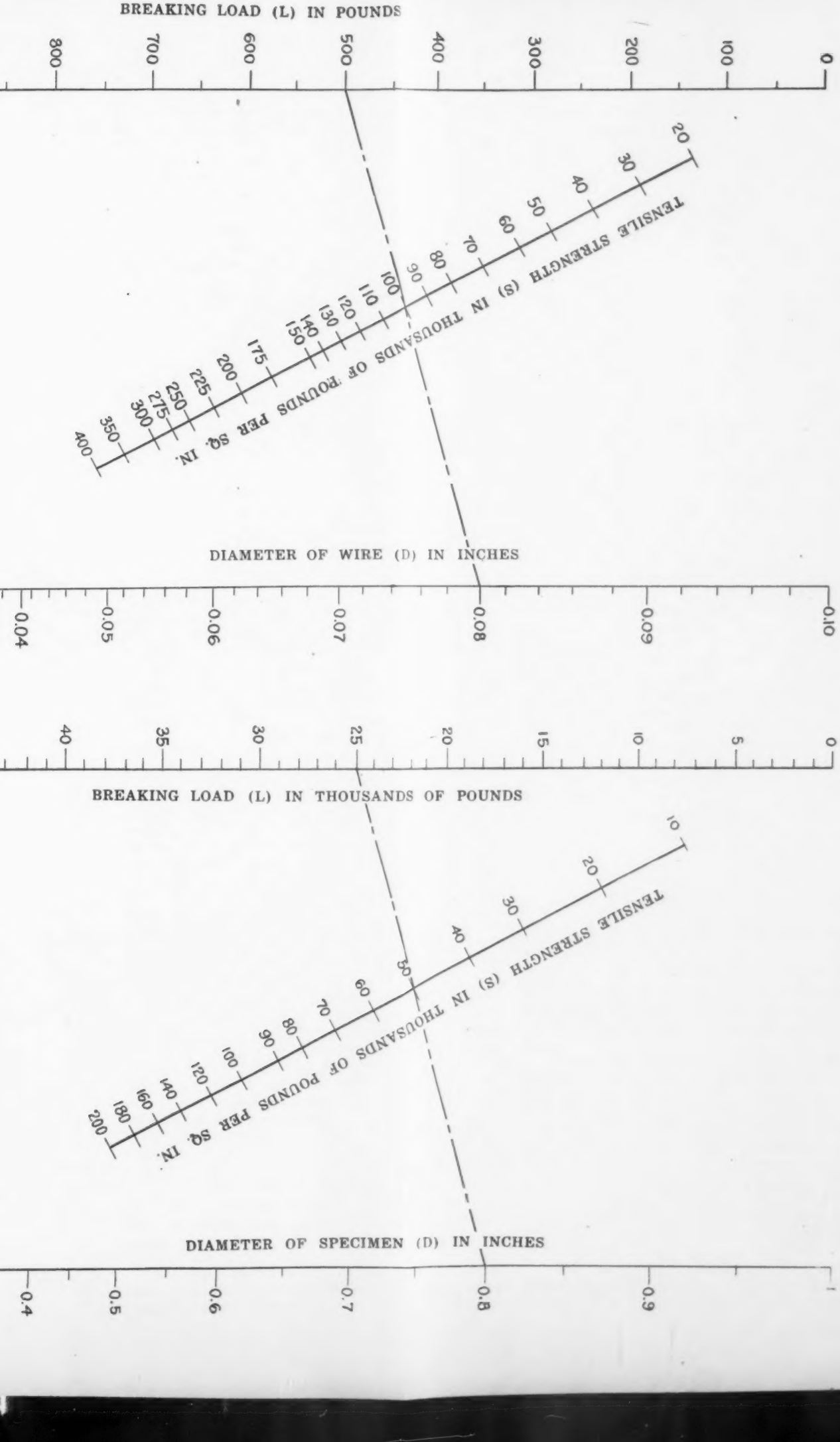


FIG. 2—TENSILE STRENGTH OF STEEL IN RELATION TO BREAKING LOAD AND DIAMETER OF WIRE. THIS CHART IS FOR WIRE UP TO 1 IN. IN DIAMETER






BREAKING LOAD (L) IN POUNDS
800
700
600
500
400
300
200
100
0
TENSILE STRENGTH (S) IN THOUSANDS OF POUNDS PER SQ. IN.
20
30
40
50
60
70
80
90
100
110
120
130
140
150
175
200
225
250
275
300
350
400
DIAMETER OF WIRE (D) IN INCHES
0.04
0.05
0.06
0.07
0.08
0.09
0.10
40
35
30
25
20
15
10
5
0
BREAKING LOAD (L) IN THOUSANDS OF POUNDS
TENSILE STRENGTH (S) IN THOUSANDS OF POUNDS PER SQ. IN.
10
20
30
40
50
60
70
80
90
100
120
140
160
180
200
DIAMETER OF SPECIMEN (D) IN INCHES
0.4
0.5
0.6
0.7
0.8
0.9
1

equation will depend upon the values which we choose for m_1 and m_2 as well as K. The value of m_1 and m_2 will depend upon how long we wish to make our scales. For example, the maximum length of the L scale will be the value which we choose for m_1, multiplied by the maximum value of L, which we choose when selecting our limits at the beginning. Obviously m_1 must be taken at such a value that the length of the chart will neither be too long, in which case it would be hard to handle and use, nor too short when accuracy would be lost. The values of m_1 and m_2 should be selected and then the maximum length of the L and D scales determined after which the lines may be laid off so that when finished the chart will be about rectangular in shape. The value of K may then be determined and selected to correspond to the width desired. It is best perhaps to select K a whole number although this is not necessary.

The values of these constants having been determined we are ready to lay off the scales. Before doing this, however, it may be well to state here the values chosen in laying out the original of the chart given in Fig. 1. These were $m_1 = 0.008$, $m_2 = 800$, $K = 9$ in., which made the equations read as follows,

$$X = m_1 L = 0.008\,L, \quad Y = m_2 D^2 = 800\,D^2$$

$$Z = \frac{K\,m_1\,0.785\,S}{m_1\,0.785\,S + m_2} = \frac{9 \times 0.008 \times 0.785\,S}{0.785 \times 0.008\,S + 800}$$

$$\text{or } Z = \frac{0.0565\,S}{0.00628\,S + 800}$$

This means that the length of the diagonal A-B Fig. 3 was exactly 9 in. and that these scales were laid out with these equations. The equations of the scales for any values of the constants are determined in the same manner.

It is now a very simple matter to lay out these scales. Take the equation of the L scale for illustration; this reads

$$X = 0.008\,L$$

Into this formula we substitute various values of L varying from the minimum to the maximum of our limits merely multiplying these values by the constant 0.008 to get the value of X which corresponds. Take this value of X thus obtained and lay it off in inches along the line A-C from A. The first point shown (Fig. 1) is $L = 100$, which gives a value of $X = 0.008 \times 100 = 0.8$ in. The point where $L = 100$ is therefore just 0.8 in. down from the point A. Obtain the value of Y in the same manner from the equation of that scale. Note, however, in this case that D appears as D^2. The point on the scale is marked D, however, and not D^2. The S scale is somewhat more complicated, although it should not cause trouble. Simply substitute various values of S and solve for Z. This may be a little tedious, but it can be quickly carried out on the slide rule. These values of Z thus obtained are laid out along the diagonal from A. If this is all carried out with reasonable care and accuracy a straight line across the three scales should solve the formula accurately.

The reader must remember that he has perfect freedom in selecting his constants. A little practice soon enables one to automatically select good values. These constants may be any decimal number. For practical purposes a larger chart than the one shown would be made in order to obtain better accuracy. To do this simply increase the value of the constants.

The chart shown in Fig. 2 and built up for the same formula only using different limits is based upon the same theory. It may be of interest for the reader to know the values of the constants used in this chart and the equations of the scales. The constants chosen were $m_1 = 0.00016$, $m_2 = 8$, $K = 9$ in.

Which makes the equations read,

$$X = m_1 L = 0.00016\,L, \quad Y = m_2 D^2 = 8\,D^2,$$

$$Z = \frac{K\,m_1\,0.785\,S}{m_1\,0.785\,S + m_2} = \frac{9 \times 0.00016 \times 0.785\,S}{0.00016 \times 0.785\,S + 8}$$

$$= \frac{0.00113\,S}{0.0001265\,S + 8}$$

The scales are laid out in exactly the same manner as given above for the chart shown in Fig. 1.

Chart for Per Cent Reduction of Area

Wire is manufactured by first rolling the steel into small rods when hot and then drawing the rods down to the required size cold. This reduction is accomplished by drawing the rod through successive dies, each of which reduces the sectional area of the rod. This drawing and reducing process hardens and crystallizes the metal so much that if carried far enough the wire would break. When the metal has become crystallized by drawing it may be put back into the normal state again by annealing, that is heating to a certain temperature for a certain period of time. This treatment softens the metal so that further drawings may be carried out and so on until the desired size is reached. For small wires several annealings are necessary before the desired reduction is reached.

The per cent reduction is based upon the area before the draft. A 25 per cent reduction of area is a good draft for steel, but as high as 80 per cent reduction is often possible in one draft in copper. These maximum values vary considerably in the different classes of steels and it is not always desirable to draw the steel to its maximum before annealing. The maximum drawing which the steel will stand is seldom carried out in one draft but rather in two or three. This requires less power to get the wire through the die and gives a better structure in the finished product. As this per cent reduction is based on the original area we may write the following:

$$R = \frac{A - a}{A} = \frac{0.785\,D^2 - 0.785\,d^2}{0.785\,D^2} =$$

$$\frac{D^2 - d^2}{D^2} = 1 - \frac{d^2}{D^2}$$

in which, D = Diameter of wire or rod before drawing in inches.
d = Diameter of wire after drawing in inches.
R = Per cent reduction in area.

This formula also applies to the reduction in area of a tensile strength specimen. D and d here stand for the diameters before and after breaking respectively.

Here again we have a formula of the simple product type which may nicely be built up into a graphical chart. Such a chart is shown in Fig. 4 and can be made to include all possible range of variables. It will be noticed that the two outside lines each have two scales, one running from 0.10 in. to 1 in. and the other from 0.01 in. to 0.1 in. Both the D and d scales are the same. The diagonal or reduction of area scale is the same for both limits chosen and would also hold good for limits of D and d from 1 in. to 10 in. if such sizes were of any value.

This chart is read the same as those given above, that is by simply drawing a straight line across the scales. The illustration given shows an initial

diameter D of 0.8 in. and a final diameter d of 0.5 in., which nets a reduction of area of about 61 per cent. Note that the same per cent reduction would have resulted had we taken a wire 0.08 in. in diameter and drawn it to 0.05 in. Like scales must be used, which means if we use the scale on the outside of the D line, then we must use the scale on the outside of the d scale.

In this chart as in the preceding the accuracy depends upon the size and limits taken. The theory is much the same as that given above and enough will be given here to enable the reader to construct one for himself to suit his own needs. Let us then rearrange the formula to read as follows:

$$1 - R = \frac{d^2}{D^2}$$

We first select the desired limits and the size which we wish to make the chart. The size will be determined by what is convenient to handle and use. Sometimes large charts are made and placed underneath a piece of plate glass on the desk where it is at all times available for ready use. A large chart may also be pasted upon a cardboard, thus causing it to lie flat for ready use.

The values of m_1 and m_2 as well as K are thus selected and the equations of the scales written down. The equations used by the writer in the originals of the chart here shown were as follows:

$X = m_1 d^2$, $Y = m_2 D^2$, $K = 9$ in. from which,

$$Z = \frac{K m_1 (1 - R)}{m_1 (1 - R) + m_2} = \frac{9 \times 800 (1 - R)}{800 (1 - R) + 800} = \frac{9 - 9R}{2 - R}$$

As the limits for D and d were the same it was possible to select m_1 and m_2 equal which causes them to cancel out in the Z equation. We selected a value of 800 when the limits were 0.01 in. to 0.1 in. and a value of 8 when the limits were 0.1 in. to 1 in. The canceling of these constants in the Z equation accounts for the R scale being the same for both sets of limits, a feature which greatly simplifies our chart and makes it applicable to a wider range of the variables. The maximum length of the D and d scales are then 8 in. Any other maximum value may be chosen by the reader to suit his needs.

Sometimes the accuracy required in the solution of these formulæ is greater than it is possible to obtain on any chart. In this case the values must either be worked out by hand or on the slide rule, the latter usually giving sufficient accuracy. The writer wishes to point out here how these may be run through with one setting of the rule. Let us first consider the tensile strength equation,

$$S = \frac{L}{0.785 D^2}$$

which may be written,

$$\frac{D^2}{1.275} = \frac{L}{S}$$

To solve this with one setting of the slide rule, the ordinary polyphase rule being considered, first find the value of D on the lower or D scale of the rule. Directly above on the A scale the value of D^2 will be registered by the runner. Next move the slide until the constant 1.275 on the B scale comes under the hair on the runner or opposite D^2 on the A scale. The slide is now set and must not be changed. Move the runner until the value of L is found on the A scale and directly underneath on the B scale will be found the value of S, which is desired. With the slide set as described a set of values having the same D can very quickly be run off. This condition often exists when the standard specimen is used or a large number of tests are run on a certain lot of wire in order to get the average tensile strength. At any rate this operation involves but one movement of the slide and one of the runner, which greatly reduces the time required. The principle involved is, of course, merely that of direct proportion.

Considering now the second formula which reads,

$$R = 1 - \frac{d^2}{D^2}$$

Find the value of d on the lower or D scale and then run the slider until the value of D on the C scale comes opposite to it. Read off on the B scale in the reverse order the value of R underneath the index 1 on the A scale. An example will make this clear. Taking our previous illustration of $D = 0.8$ in. and $d = 0.5$ in., we find 8 on the D scale and divide it by 5 on the C scale. Read underneath the 1 on the A scale and find 39, but when read in the reverse order, that is from the right-hand end, it becomes 61 per cent. This reading in the reverse order can be done very quickly after a little practice. What actually happens in this operation is a proportion between D^2 and d^2 on the A and B scales which is equal to $\frac{1}{R}$. This system prevents the necessity of subtracting the value which we get each time from 1 in order to obtain the reduction of the area in per cent.

When extreme accuracy is not required the graphical charts may be used and should prove good time savers to the steel man who is constantly working up data of this kind.

Good Advice to Foreign Born

Commenting upon the strike situation foreign language newspapers which circulate widely among iron and steel workers in the Youngstown, Ohio, territory urge their readers to avoid violence. "We believe it is the business of employees themselves to present their grievances and not for outsiders to do it for them," stated an editorial printed in influential Hungarian and Slovak weeklies. "We know by actual facts that only a negligible percentage of the Magyar born, mostly skilled and semi-skilled steel workers, have joined the American Federation of Labor unions."

The foreigners are reminded that in times gone by they have been made the victims by labor organizations, especially when the unions lost a fight which they waged, and are urged to be more careful now.

The publications recall the riots at East Youngstown, Ohio, in January, 1916, precipitated by labor disturbances at the plants of the Youngstown Sheet & Tube Co. and the Republic Iron & Steel Co. In that instance, the papers say, following an orgy of arson, looting, violence and murder, "union labor hastened to wash its hands of the blame," which was shoved onto the shoulders of the "barbarian" foreigner.

Announcement is made of the consolidation of Waldo Brothers, Inc., building materials, established in 1869, and the Harold L. Bond Co., construction equipment, established in 1902, both of Boston, under the firm name of Waldo Bros. & Bond Co., 181 Congress Street, effective Jan. 1. The officers of the new organization are: Harold L. Bond, president; C. Sidney Waldo, first vice-president; Llewellyn Howland, vice-president; Harold C. Bond, secretary; Frederic W. Mattheis, sales manager; James G. Lincoln, treasurer. These gentlemen and Roger Ernst and Frank M. Bates constitute the board of directors.

Plant for Casting Automobile Cylinders

Molding Machines Travel and There Is Special Sand Handling from Bins Along the Side—Structural Design Permits of Saving in Steel

IN solving the problem of quantity production of castings there are always several lines of possible attack. Some people favor mechanical carrying systems for as much of the material as possible, keeping the molders and coremakers stationary. A system of this kind predetermines the maximum pace at which the molding unit can work, and any delays which may take place serve to reduce this predetermined possible or theoretical rate. Another principal path that may be taken in solving this problem is to move the molding machines. The latter plan has a number of advantages.

In the case of the Holmes Foundry Co., with plants at Port Huron, Mich., and Sarnia, Ontario, special cylinder casting units have been devised and built in each place. L. G. Blunt, who developed the Port Huron plant and who is now at the head of the Holmes Foundry Co., for years has made a study of molding and coremaking methods for the large production of automobile castings, and the cylinder units described in this article are the first of the new units designed for this purpose.

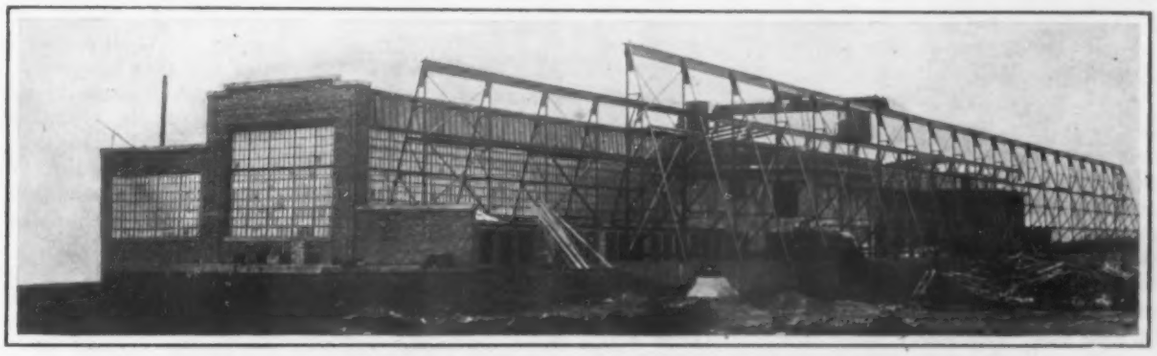


FIG. 1.—Exterior View, Showing Yard Crane, Sand Bins and Charging Platforms

Four Production Units

From the general plan it will be noted that the arrangement consists of a foundry designed for four cylinder production units or casting bays, with a core room at each end. A cupola is provided for each two bays. Raw material enters on one side of the building and passes to the cupola stage or charging platform, and the iron is delivered to the floors adjacent to the cupola. The castings pass directly from the side of the floor to the series of shake-out gratings over a continuous tunnel parallel with the molding floor.

The general cross-section illustrates the flow of material from the incoming track on one side to the shipping track on the other. It includes the arrangement of the charging platforms, the cross-section of the molding floor, the shake-out gangway with the shake-out tunnel under it, cleaning bay and shipping bay.

Back of or adjacent to the shake-out tunnel is a series of tumbling mills, and adjacent to these the chipping and cleaning floor. Back of the shipping gangway is a series of doors opening into the box cars at the side of the plant. The receiving track on one side is only a few inches lower than the foundry floor, but the discharge or shipping track on the opposite side is depressed so as to bring the box car floor at the shipping floor height.

Handling Pig Iron and Other Raw Materials

In operation the pig iron is unloaded with a magnet and most of the iron taken directly to the charging platforms. The charges are all made up on the platform. The reserve stock of pig iron is stored in the yard under the crane. On each of the two charging platforms is a coke bin with a capacity of several carloads of coke, and at one point in the yard there is an unloading hopper under the track where hopper-bottom coke cars can be dumped and the coke loaded into boxes which the crane handles into the coke bin.

The sand bins are located along the stock yard side of the foundry parallel with the molding floor, and the portion of the bins adjacent to the molding floor is used for the storage of molding sand. These bins are shown in Fig. 1, and they can also be seen in Figs. 2 and 3. They are kept low enough so as not to interfere with the general foundry lighting, and the bin walls serve as a support for the steel work that carries one of the crane runways. By reference to Fig. 1 and to the plan it will be noted that the bins for the first 20 ft. at one end of the building project further than those along the remainder of the foundry. The reason for this is that a considerable portion of the core sand is received in drop-bottom wagons of the Studebaker type. When a wagon arrives the pin in the double-tree is pulled and the team driven off so as to detach the neck-yoke and double-tree from the tongue. The wagon is then lifted by a four-hook sling attached to the crane hook and is carried over a hatch in the top of this projecting portion of the bin. The driver retains his seat and trips the bottom when over the hatch. The wagon is then set on the ground, the team backed into place and the double-tree pinned in position once more, so that the team proceeds on its way for another load of sand.

The sand that is stored in the remaining bins is received either in gondola cars or box cars, and a portable belt conveyor is used for transferring this sand from the cars to the bins, the conveyor being shifted from place to place by the crane.

The advantages of having the sand bins along the side of the foundry are several. Molding sand

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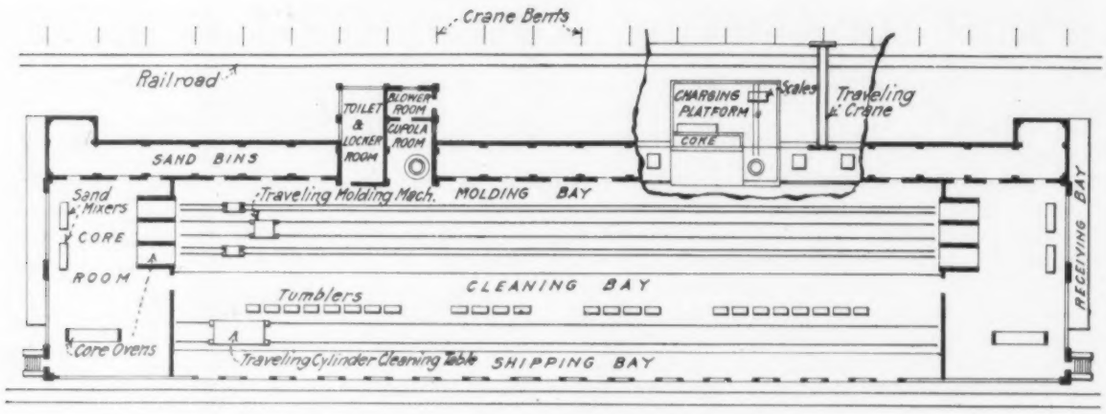

FIG. 2.—Plan of Cylinder Shop for Holmes Foundry Co.

may be transferred from the molding sand bins to the floor directly in front of each bin, thus minimizing the amount of handling necessary. The location of the bins against the side of the building renders them practically frost-proof, and the space can be better utilized as bins than as a storage yard. The cupolas had to be located outside of the main line of the building, which forced the crane runway away from the building columns a certain distance, and hence the space between the crane runway and the building columns could be well utilized for bins.

Fig. 3 shows the reinforced concrete structure supporting the charging platform, with the timber bulkheads for retaining the iron on the charging platform, together with the concrete coke bin which covers a portion of the space under the crane on the charging platform and extends back to the main building column line.

The cupolas have an enlarged stack above the charging floor so as to reduce the amount of sparks thrown out. The space beneath the charging platform is utilized for housing the cupola blowers and toilets on the ground floor and for an air compressor and stock room on the second floor.

Lightness of Crane and Saving in Structural Steel

The cross-section shown in Fig. 5 gives an idea of the general structure of the building. It will be noted that a latticed structure has been built out from the columns, which virtually shortens the truss line and carries the crane runways for the underslung cranes in the pouring and cleaning bays at a considerable distance from the column points. This disposition of the runways makes possible the design of a lighter crane of a given capacity and tends to more uniform or easy crane operation. The form of building showed a number of unexpected advantages when it came up for study, and it was found possible to make quite a saving of structural material by the design, which thereupon was made the subject of a patent application.

In the top of the monitor on each side is a series of top-hung sash, and similar sash are placed along the top of the cleaning room. This disposition of the sash makes possible the proper control of the ventilation. The regular side-wall sash is the usual metal type, and the introduction of the sand bins between the charging yard and the side wall tends to reduce glass breakage. The general disposition of the machinery is shown in Fig. 2.

The core ovens for large work are night ovens of the carry-in type, with doors at each end. The

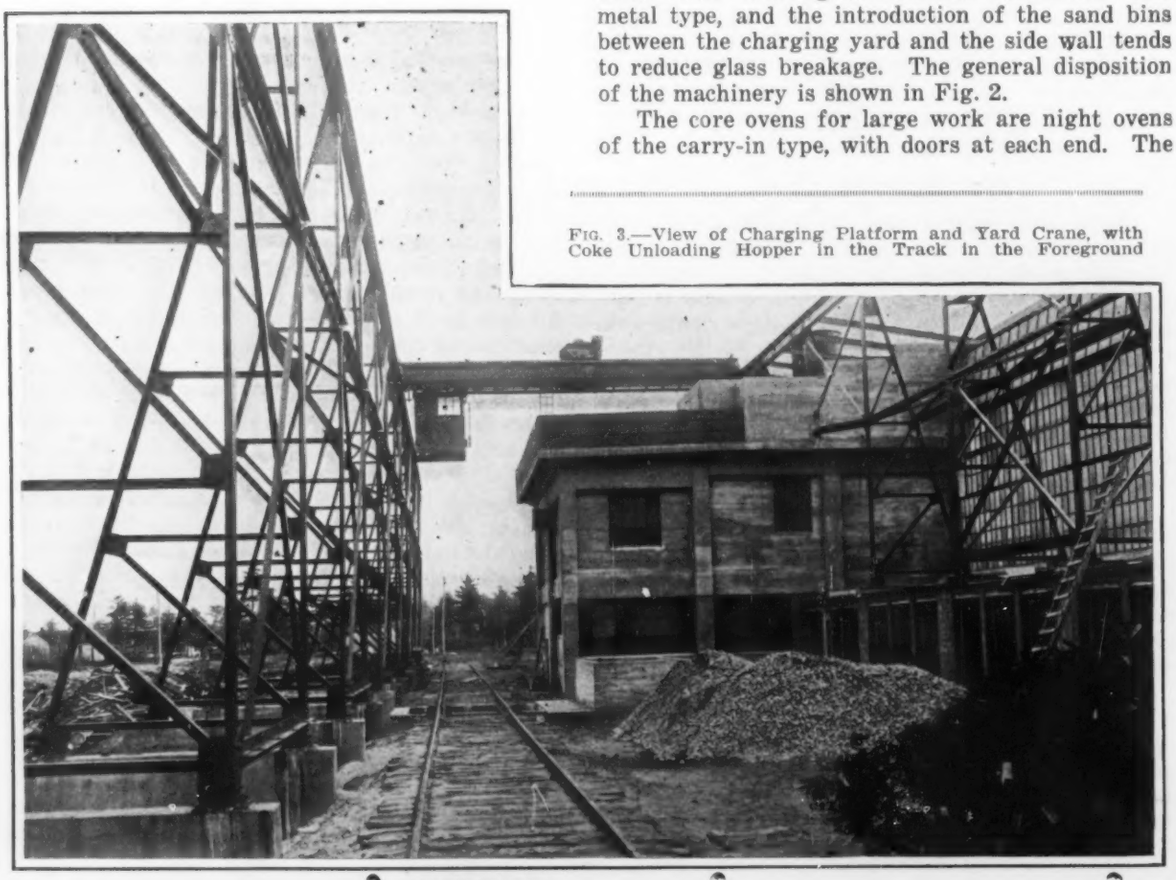

FIG. 3.—View of Charging Platform and Yard Crane, with Coke Unloading Hopper in the Track in the Foreground

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FIG. 4.—Tumbling Barrels as Seen from the Back or Chipping Room Side

coremakers work directly in front of the ovens, with their benches almost in the entrance, and the next day the dried cores are taken out of the opposite end into the foundry, as shown in Fig. 6. The jacket and smaller cores are baked in a battery of ovens placed at the side of each coreroom, as indicated in the plan.

Special Sand Handling and Traveling Molding Machines

A special machine has been designed for handling and preparing the molding sand. This is shown on the track in Fig. 6. At the time of the shake-out the men proceed down the floor and shovel the sand into the riddle of this machine. This leaves a continuous heap on each of the four molding floors. In this view the entrances to the sand bins alongside the plant are also plainly visible, as well as the cupola spout and the underslung crane used for the delivery of iron and the pouring of cylinders.

In the background in front of the ovens one of the molding machines partly assembled can be seen on its track. These molding machines travel along each side of the sand heap, one making copes and the other drags, and the molds are set down by hand.

Molding operations begin at a point adjoining the cupolas, and as soon as a sufficient number of flasks have been placed on the floor to assure continuous operation the cupolas are put under blast and pouring started, so that the pouring gang is following up the molding gang throughout the day. All work is poured before shake-out begins. As soon as the floor has been poured off the shake-out gang starts to work, using the underslung crane over the molding floor, and by means of certain pass-overs carries the castings from the crane in the molding bay to the crane in the cleaning bay. The castings are then shaken out and the core sand allowed to run through gratings in the top of the sand tunnel under the knock-out floor, and accumulate in push cars in the tunnel. These cars are taken to the dump the subsequent day.

Shaking Out and Tumbling

As soon as the castings are shaken out they are piled into tumbling mills and tumbled, and a sufficient number of mills is provided so that the entire day's output can be tumbled with one filling of the mills. A portion of the mills is shown in Fig. 4. These are driven from motors in a tunnel next to the shake-out tunnel, and the exhaust is taken out through this tunnel under the foundry floor. This leaves all of the space above the mills available for crane handling. Any defective castings which may be found during knock-out are left on the shake-out floor, so that when the molder arrives in the morning he finds this defective work right at his elbow staring him in the face.

During the day shift the cylinders are taken from the tumbling barrels over the back side and

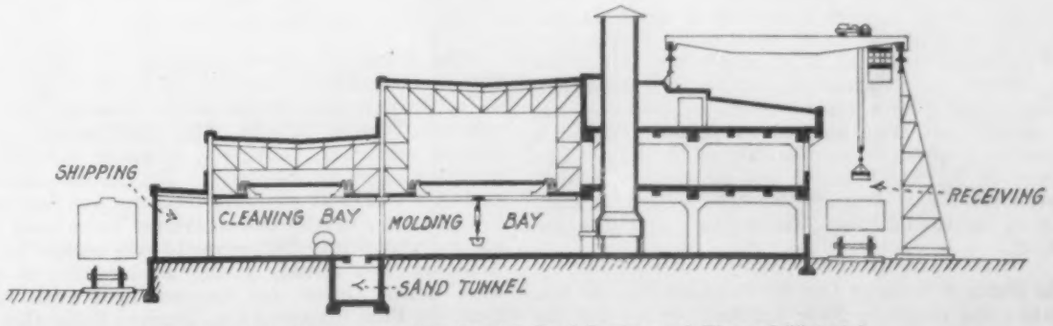


FIG. 5.—Cross-Section Showing Special Roof Design and Flow of Material

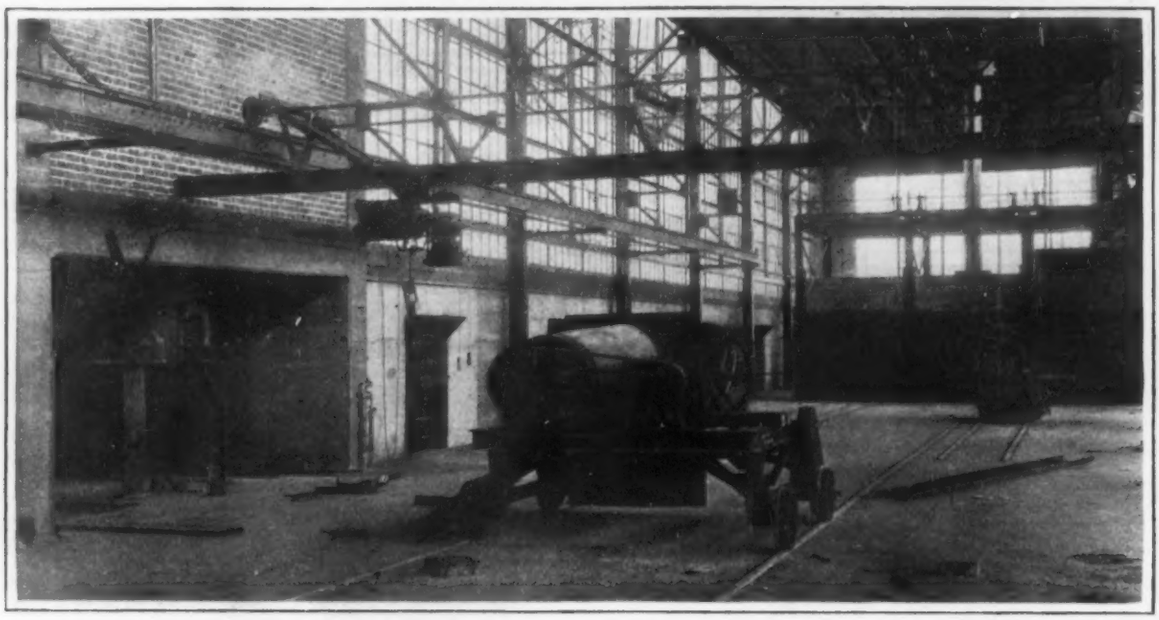


FIG. 6.—Molding Bay Showing Special Sand-Mixing Machine, Underslung Crane, Molding Machine and Core Ovens

are chipped, inspected and water-tested on a special chipping platform, with clamping jigs, which travels on a broad-gage track back of the tumbling mills. One of the tracks in this system can be seen in the floor in Fig. 4, but the chipping machine was not in position at the time this view was taken.

The dust from the tumbling mills passes to the right and left from the center of the plant toward the ends and the dust arresters are arranged on an overhead structure adjacent to the ends of the core-room, as shown in plan in Fig. 2. The hoppers on the dust arresters can be discharged through an opening in the tunnel roof into the sand cars in the tunnel.

With this design of plant a pound of iron travels the minimum distance from the time it is raw material in the supply yard until it lands in the car on the opposite side as a finished casting, and the amount of handling labor has been reduced to a minimum, but in no place is the sequence of operations so arranged that the temporary absence of any one man from his post will shut down operations in that department or affect the general flow of work through the plant.

The plant was designed by the H. M. Lane Co., which also laid out the equipment and designed the special jigs, fixtures, etc. The owner acted as general contractor.

Buys Control of Greenfield Tap & Die Corporation

Frank O. Wells has sold his controlling interest in the Greenfield Tap & Die Corporation, Greenfield, Mass., to Frederick H. Payne. Mr. Wells retire as president and director of the corporation, and plans to relinquish all active business relations owing to his advanced years.

Mr. Payne succeeds Mr. Wells as president. He has been actively connected with the corporation several years as vice-president. F. G. Echols, vice-president and general manager, is a member of the board of directors, succeeding Mr. Wells. Aside from these changes, the management remains unchanged, and the policy of the corporation will be as heretofore. Because of Mr. Payne's membership in the Boston and New York banking firm of Tucker, Anthony & Co., report had it the corporation was to issue new stock. No such act is contemplated by Mr. Payne or others in the organization.

The corporation was incorporated April 1, 1912, with a controlling interest in the Wells Brothers Co., established in 1876, in the Wiley & Russell Mfg. Co., established in 1870, and the A. J. Smart Mfg. Co., established in 1906, all located in Greenfield. These three companies still retain their corporate existance, but their capital has been reduced to $1,000. Within a comparatively short time, the Nutter & Barns Co., Hinsdale, N. H., was acquired and subsequently moved to Greenfield. The Bickford Machine Co., Greenfield, also is in the combination. Gages, taps and dies are produced.

The Butts & Ordway Co., 33 Purchase St., Boston, has taken the exclusive New England agency for the Cleveland Milling Machine Co.'s milling cutters.

Heavy Export Movement

WASHINGTON, Dec. 30.—Notwithstanding adverse exchange conditions, exports from the United States during the month of November reached the second highest figure in the history of the country. The total value of exports during the month was $740,921,163, as against $631,910,046 in October, $596,534,841 in September, $646,054,425 in August, and $568,687,515 in July. The high water mark was recorded in June, when the total mounted to $928,379,203.

Imports also were second highest in the history of the country, so far as value was concerned. The imports in November totaled $429,211,077, as against $401,873,666 in October and $435,501,118, the record total, in September.

Exports for the 11 months ended with November totaled $7,242,000,000, against $5,583,000,000 for the corresponding period of 1918. Imports for the 11 months this year were $3,528,000,000, as against $2,820,000,000 for the same months of last year.

The Aetna Foundry & Machine Co., Warren, Ohio, has been awarded a contract for three 72-in. and one 48-in. tinning units by Baldwin's Canadian Steel Corporation, Toronto, Canada. This order includes tin pots, tinning machines, conveyors, cleaning machines and auxiliary cleaning machines. The Aetna company is exclusive maker of auxiliary cleaners, and has recently brought out a special 10-roll cleaner to be used in connection with them. This gives 14 rolls altogether. This combination is already giving good results in several steel mills. Orders for cleaners have been received from the Buhl Stamping Co., Detroit; Follansbee Bros., Pittsburgh, and Sturges & Burn Mfg. Co., Chicago.

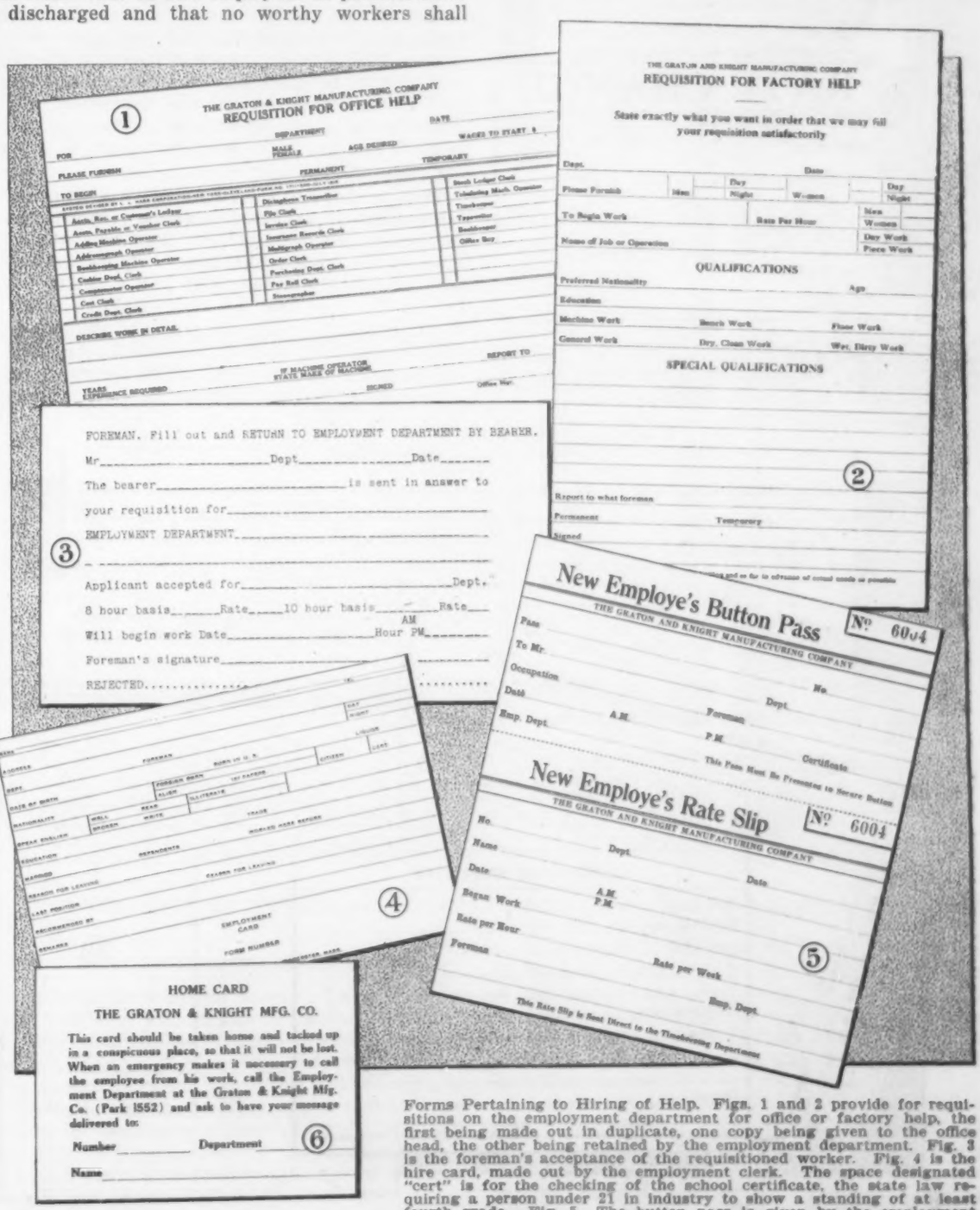
How One Manufacturer Handles Labor

Employment Department of Graton & Knight Mfg. Co. Keeps Continuous Contact with Each Workman from Hiring to Leaving

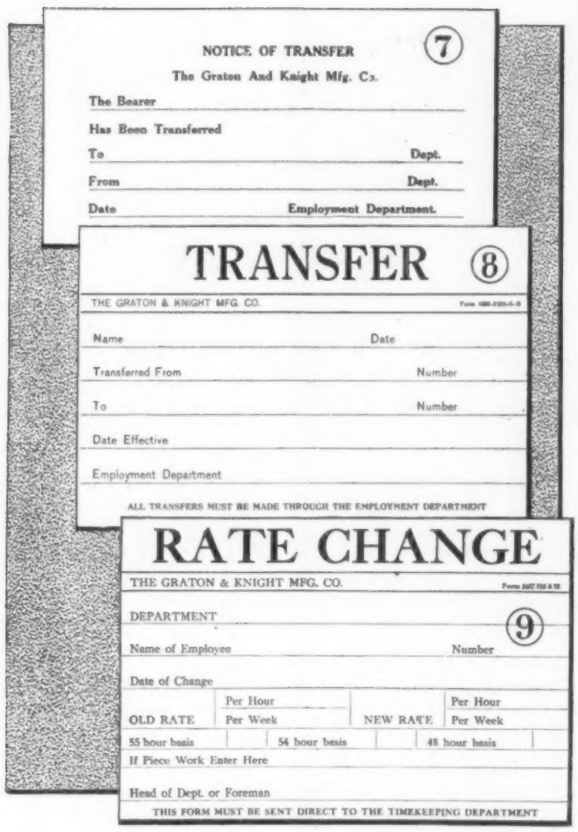
BY ROBERT I. CLEGG

THE Graton & Knight Mfg. Co., Worcester, maintains an employment department not only to hire help but also to serve as a clearing house for employees' inquiries after they have become part of the organization. Consequently the department holds that as few employees as possible shall be discharged and that no worthy workers shall be allowed to go if there is any department where they may be employed, believing that a misfit in one department is a possible fit in some other.

The department supervisor, T. C. Greene, and his assistants have thus a big task which is handled


1
THE GRATON & KNIGHT MANUFACTURING COMPANY
REQUISITION FOR OFFICE HELP
2
REQUISITION FOR FACTORY HELP
QUALIFICATIONS
SPECIAL QUALIFICATIONS
3
FOREMAN. Fill out and RETURN TO EMPLOYMENT DEPARTMENT BY BEARER.
EMPLOYMENT DEPARTMENT
4
5
New Employe's Button Pass
No. 6004
New Employe's Rate Slip
No. 6004
6
HOME CARD
THE GRATON & KNIGHT MFG. CO.
This card should be taken home and tacked up in a conspicuous place, so that it will not be lost. When an emergency makes it necessary to call the employee from his work, call the Employment Department at the Graton & Knight Mfg. Co. (Park 1552) and ask to have your message delivered to:
Number
Department
Name

Forms Pertaining to Hiring of Help. Figs. 1 and 2 provide for requisitions on the employment department for office or factory help, the first being made out in duplicate, one copy being given to the office head, the other being retained by the employment department. Fig. 3 is the foreman's acceptance of the requisitioned worker. Fig. 4 is the hire card, made out by the employment clerk. The space designated "cert" is for the checking of the school certificate, the state law requiring a person under 21 in industry to show a standing of at least fourth grade. Fig. 5. The button pass is given by the employment department and after the medical examination is surrendered in exchange for the numbered button, constantly worn by the employee. The rate slip, filled out, is forwarded to the timekeeping department and the new employee's name placed on the payroll. Fig. 6. This card is displayed conspicuously in the workman's home for the convenience of his family in communicating with him

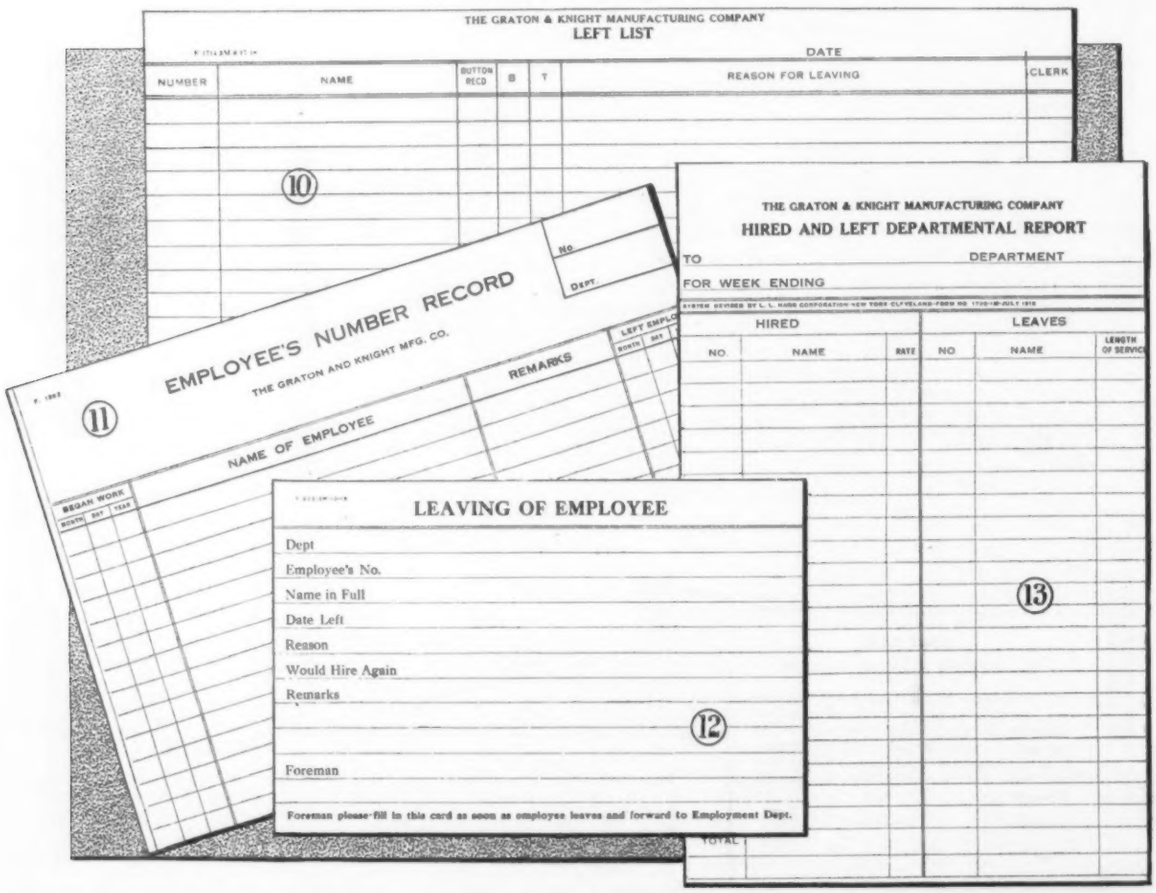


Changes in Jobs or Wages. Fig. 7. This card accompanies the workman who is transferred from one department to another. Fig. 8. This transfer card goes to the timekeeping division. Fig. 9. This is filled out by the foreman or department head and sent to the timekeeper

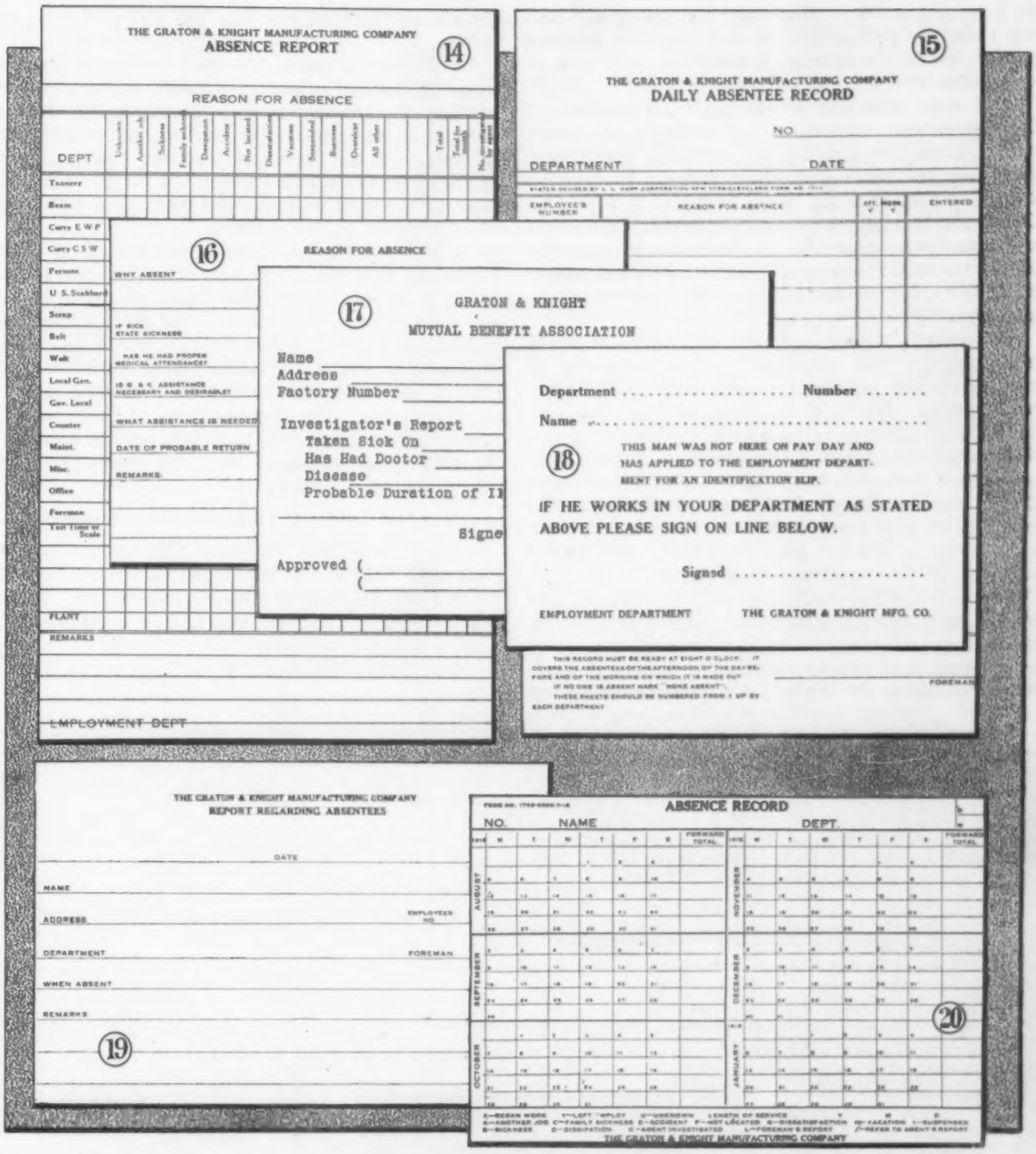
in a large way, for the department is a center of information to which all employees come for assistance. In order to keep track of the varied responsibilities a very complete, but simple, system of records is kept as shown by the illustrations. The employment department handles between 3000 to 6000 applicants each month.

From the time the employee applies for work until his connection with the company is severed every effort is made to make him feel at home. He is not chafed by oral and perhaps contradictory rules and regulations. Simple instructions and general information are given to him in a permanent printed form. He gets the particular information with regard to his job from his foreman. He is made to feel that the employment department is always open to his calls and inquiries, that it is at his service and will do all that can be done to make him feel at home. Old employees are impressed with the importance of giving a welcoming reception to the stranger, of feeling that they, as well as the company and the newcomer, will all profit by the quickness with which the newly-hired becomes familiar with the current practice of everyday shop affairs.

Many a shop has been a closer corporation in the reserve and the chill that froze the very atmosphere among the benches and tools than ever was imagined by the office authorities. Gages were withheld by fellow workmen who had a rather hostile feeling in order that the new employee could not at first make so good a showing and embarrass the old hands. This was done also to take his measure and properly initiate him. If he showed a spirit of becoming subordination to his fellows, then all



Leaving of Employee. Fig. 10. Page from the book in the employment department that is compiled from the cards represented in Fig. 12. Fig. 11. A page from the loose-leaf record to keep track of employees' numbers, when employed and when they leave. Fig. 12. The foreman fills out this card upon the leaving of an employee, the latter taking it in a sealed envelope to the employment department. Fig. 13. This is made out in duplicate and a copy goes weekly to the superintendent of every department.



Absence Records. Fig. 14. A daily summary prepared by the employment department to show causes of absences in all the plant. Fig. 15. This is made out in duplicate by the foreman before 8 a. m. to cover absentees of that morning and the afternoon of the day before. Fig. 16. This is made out in duplicate and not only shows causes of absences but also indicates whether sickness cases may be aided by the company. Fig. 17. This card is filled out and sent to officials of the Graton & Knight Mutual Benefit Association in case of sickness. Fig. 18. The employment department sends this card to the foreman for identification when the employee has been absent on payday. Fig. 19 is the reverse side of Fig. 16. Fig. 20. This blank, using both sides, covers every day of the year and shows length of service in days, months and years. By the symbols quick reference may be made to the various reasons causing absence

was well, and gradually the "ice" gave way to more cordial relations.

Passes Given for Irregular Coming or Going

Employees wear on coat or vest a button bearing a clock number. This button is colored to identify the wearer with the department or division where he or she works. The employee late for work receives a pass from the watchman and this admits the bearer to the plant. The pass is given to the foreman on reaching the place of employment and in due course the timekeeping department in this way can make the necessary adjustment for the late arrival.

A somewhat similar pass is used for those who wish to go out during working hours. This pass is given to the watchman at the door on leaving the factory. It is the company's experience that the tendency of piece workers is to wish to go out early, rather than to come in late.

It is expected that inability to get to work will be promptly reported to the foreman with the cause of the trouble and a statement of the time it is planned to return to work. Anticipated absences are to be arranged with the foreman in advance as far as possible so that the work may continue with least disturbance.

A study of the accompanying illustrations shows that, in the company's opinion, the closest relations are desirable with the employee's family. Every employee is urged to advise his family of his button number, department, and his foreman's name, as indicated in Fig. 6. All sorts of delays and misunderstandings may thus be avoided when, in case of emergency, it is necessary to call a man from work. While employees are not called from their

work to answer the telephone, all emergency and sick calls are promptly delivered and the workers are assured of the company's desire to be of help at such times.

Not only does the employment department invite suggestions valuable to the worker's own benefit or that of the organization, but also encourages employees to recommend their friends as possible future employees. An identification card is furnished for the purpose and such persons are given preference wherever this is feasible. Suggestion boxes are placed in several conspicuous places about the factory, into which workmen are encouraged to drop their ideas.

A renting bureau is a part of the employment department. This provides for the securing of board, rooms or tenements. No charge is made for this service. While it is expected that the employees will arrange to take care of their bills and avoid wage attachments, the company realizes that many such instances would never get to that stage if only an opportunity had been provided for the employee to secure advice earlier. The employment department is always glad to consult and advise with any of its employees so concerned.

There is a labor committee holding frequent and regular meetings and comprising the chief chemist, the factory superintendent, the head of the curry department, and the employment department head, the latter being secretary. All questions covering morale are peculiarly within the scope of this committee.

A library of about 300 good books on practical tanning, leather dressing, production factors, prevention of accidents, shop management, factory costs, systematizing, letter writing, advertising and salesmanship has been provided for the employees. Suggestions are constantly invited for further additions to the stock of books and pamphlets which will be of interest to the workers.

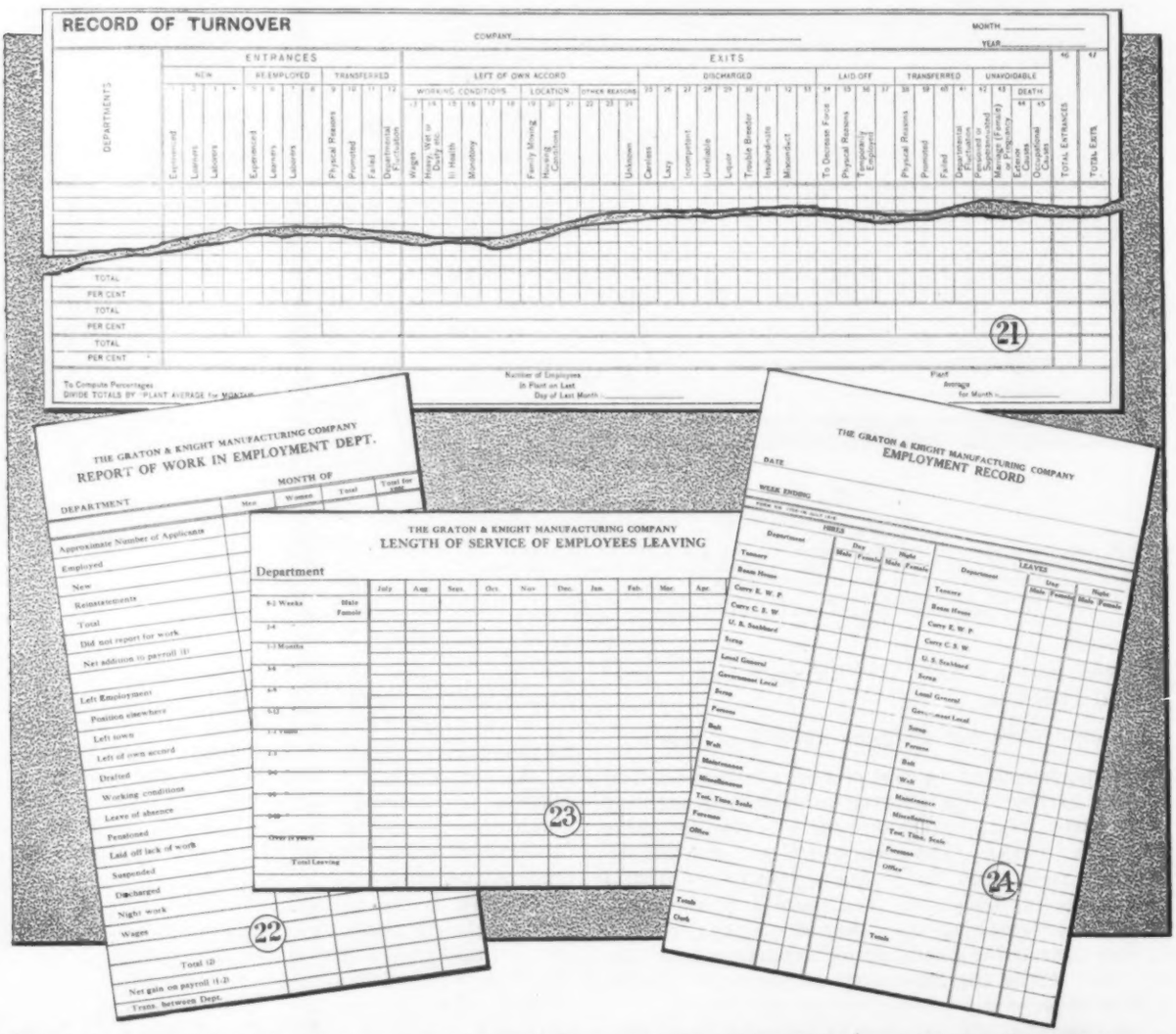
A hospital staff furnishes certificates of health regarding new employees and also is at the service of all workers for the treatment of accident and sick cases. Figure 25 shows a leaf from a book containing over 400 job descriptions which have been prepared to enable the employment department to explain in detail the nature of the work on any particular job. The thoroughness of its scope will be evident on inspection and it is readily adaptable to other types of plants than the one where it is now found so valuable.

Ways of Avoiding Accidents Are Enumerated

Every employee entering the service of the Graton & Knight Co. is warned of things he must do to avoid accident to himself and others. Injury not only keeps him idle but will be a hardship to his family and the community.

He is expected to agree to:

Wear goggles when in danger from flying chips or dirt.



Records for Determining Labor Turnover. Fig. 21. This form, prepared by the Employment Managers' Association of Boston, is not used in detail, but merely as a basis for figuring. The side shown goes minutely into the factors bearing on entrances and exits. Fig. 22. This is a monthly summary of workmen joining and of those leaving, compiled by the employment department. Fig. 23. This gives an easy, compact way of comparing departments over long periods and for all the months of the year. Fig. 24. This is a weekly summary of hiring and leaving by the respective departments

THE GRATON & KNIGHT MANUFACTURING CO.
WORCESTER, MASS.

JOB ANALYSIS.

DEPARTMENT _____ DIVISION _____
HEAD or SUPT. _____
Hiring done by _____
FOREMAN _____
Description and name of Job: _____
NATURE OF WORK AND WORKING CONDITION:

Heavy	Standing	Floor	Quick	Dirty
Medium	Sitting	Bench	Slow	Greasy
Light	Walking	Bench Machine	Routine	Wet
Trucking	Odorous	Floor Machine	Varied	Clean

REPEATED OPERATION _____ OR VARIETY OF JOBS _____
Length of time required to learn Job? _____
DAY WORK OR PIECE WORK _____
How soon piece work? _____
Requirements _____
Read and Write English? _____
Schooling? _____
Age _____ Height _____ Weight _____ Nationality _____
TRAINING AND EXPERIENCE: _____
MAKE OF MACHINE: _____
DATE TAKEN Jan. 1, 1919.
REMARKS _____

PROPERTY OF EMPLOYMENT DEPARTMENT. Page

Job Analysis. Fig. 25. This is kept in loose-leaf books and arranged for quick reference. It saves the newcomer and man transferred from being misfits. A person not making good in one department can thus be examined and probably placed elsewhere and thus profit by the investigation already made on that person by the employment department when first hired. Turnover is thus reduced

Not only use every safety device but also call the attention of his fellow-workers to them.

Be mindful of any safety device that is imperfect in principle, or needs adjustment, or repair, calling attention of the foreman to the dangerous condition.

Not to clean machines while they are in motion.

Not to tamper with fire extinguishers or the electrical apparatus.

Not to fail to report to the safety inspector any used extinguisher that needs to be recharged.

Not to work on belts, pulleys, or shafting while they are in motion.

Carefully examine all appliances in use, as ladders, scaffolding, etc., to see that they are in good condition, and that all protruding nails are turned down or removed.

Keep clean all aisles and passages.

To handle all tools and machines carefully. To report all accidents or breakage to the foreman immediately. Not to run machines when out of order.

He is told what to do in case of fire:

Notify your foreman at once.
Shut the windows and the fire doors.
Keep trucks and stock out of aisles and passage-ways.
Carry out any and all instructions given by your superior.
If you are not given a definite job to do, walk to the nearest exit and leave the building.

Also what not to do in case of fire:

Don't run.
Don't lag behind.
Don't break up columns.
Don't laugh or talk.
Don't scream or make unnecessary noise.
Don't remain in the toilet or dressing rooms.
Don't try to use elevators.

Instructions are also given to notify foremen when floors around machinery are not kept clean; to use paper cuspidors, to remove waste, and take other means to maintain a clean and neat factory. To smoke only when smoking is expected, to refrain from writing or pasting pictures on walls.

Finally it is brought to the employees' attention that:

All the rules and regulations which might be adopted are useless if not observed.

All safety devices will not prevent accidents if the operator himself is careless.

All practical jokes played upon fellow-workmen usually have an element of danger, so they should be avoided at all times.

Therefore the best safety device known is a careful man. Accidents happen at the most unexpected moments. Eternal vigilance is the price of safety. If everyone will give his conscientious attention to the preceding suggestions he will provide for the safety of himself as well as for that of his fellow-workmen.

HUMAN ELEMENT AND SAFETY

The Misfit, Worried and Careless Types, and How to Deal With Them

The human element in its relation to safety work was discussed by M. F. Gartland, Marion Gray Iron Foundry, Marion, Ind., in a paper on "The Personal Element in a Safety Program for the Foundry," presented before the eighth annual safety congress of the National Safety Council, Cleveland, Ohio. A portion of the paper dealing directly with the men prone to injury and suggesting remedies is given below:

First there is the man who is a misfit. There are men in all our foundries who ought not to be there. They have been drawn into our employ through a chain of circumstances and it is hard for them to break away. Not having interest in their work they lack the incentive to become efficient workmen. They drag through the day without enthusiasm and leave when the whistle blows with a full quota of accidents piled up behind them. These are the men who make our state industrial commissions keep one eye on our ancient charts. It is because of such men as these that we have a high rate of industrial insurance for our foundries.

What are we going to do with them? Perhaps the easiest thing would be to give such a man the opportunity to find work somewhere else. We would have done that in the old days, but we hesitate to do it now; not that we love the man any more than we did, but it is not so easy to replace him with a better man. Another and better solution is to give him his opportunity in some other part of our own plant if possible. We know this plan will work because we can all call up a great number of individual cases where it has worked. The trouble is that very few if any of us have adopted it as a principle for every day application.

The next man who is a great maker of accidents is the man whose mind is ill at ease. The secret of his trouble is that his mind is focused on his own personal problem, so, of course, it cannot be focused on his work. When a man works without thinking we may be sure that he will soon make trouble for himself or for some one who works near him. When we meet with a case of this kind we must have a specific remedy. A prescription of the "shot gun variety" has no value to this man. He is not interested in generalities. His own personal problems must be met and solved. Every plant needs a squad of sharpshooters who can hit the spot every time. Call them what you will, visiting nurses, social service workers or what not, but first find your men and women who have common sense and good judgment and then turn them loose with authority enough to ride over every precedent and break every rule of the plant if this be necessary to supply the one and only remedy for the worker who is in trouble. A dozen troublesome cases for which real remedies have been found and applied are worth more to a plant as a business asset than to have entertained the whole working force in most royal style. These personal contacts with the *individuals* of our work forces are just about as important and should be carried out just as systematically as our contacts with our best customers.

The next man who makes us lie awake at nights wondering what is going to happen next is the careless man. He was born that way or his life has been such that he has grown that way. The careless man is more dangerous to his companions than he is to himself. The fortunate thing about the careless man is that we *can* educate him both as an individual and en masse. We can appeal to him on the basis of loyalty to his family and the safety of those who work with him. The careless men of our plants can be helped with safety bulletins and various other educational activities. A downward curve on the accident chart may be made a matter of pride to them. The most careless man we have may become the most careful if he should suffer a serious hurt as the result of his folloy or if he should inflict an injury upon a fellow worker. It should be said, however, that he probably will not rise to this new degree of efficiency on his own account, but that he may be led into it after a heart-to-heart talk with some member of the executive staff.

Status of the Powdered Fuel Problem*

Observations of an Engineer in the Consumer Relation—Plea for Establishing a Factor of Fineness

BY JOSEPH F. SHADGEN

THE great lesson of the war is undoubtedly the universal recognition of the value of efficiency. The continuous changes in economic conditions have taught to every industry the importance of better organization, the necessity of savings and the elimination of waste in all forms. The advantages of greater efficiency are only emphasized by today's market convulsions and they will gain further value and greater appreciation under the stimulus of the coming competition.

In no industrial activity is the tendency toward better utilization of the natural resources more clearly felt than in the burning of fuels. Combustion efficiency has become a sure necessity everywhere, not only on account of the high prices of the fuel itself but also on account of the scarcity of labor, the difficulties of transportation and the uncertainties of the market.

Coal being the fuel par excellence it is quite natural that considerable efforts have been concentrated on improving the efficiency of its combustion. All methods have been utilized: scientific investigations, practical tests and competitive calculations. New grates have been invented;, better gas producers have been developed, and pulverization has been tried out and applied to many uses.

Powdered fuels seem actually to be the great favorite in many industrial fields and a critical study as to the possibilities and limitations of this method of burning solid fuels seems to be very timely. The numerous pioneer installations have successfully overcome the original difficulties and many misconceptions have been corrected. The following lines try to put several detail problems on a scientific footing, with some suggestions for the benefit of the whole industry.

Principle of Powdered Coal Combustion

What is the secret of the success of this method of burning solid fuels? On what physical law is based the pulverization of coals?

Coal is a solid, whose specific gravity varies between 1.2 and 1.5, which means in other words that 1 pound of coal occupies a volume of 23 to 18 cu. in. Its carbon and hydrocarbons combine with the oxygen of the air to CO_2 and H_2O. This combustion is a chemical reaction requiring definite proportions of each. One pound of coal combines with 10 to 12 lb. of air occupying a volume between 120 and 145 cu. ft., somewhat like 200,000 to 250,000 cu. in. These very simple calculations bring out one fact: The ratio of the volumes of air and coal is at least 10,000 to 1 theoretically and practically 12,000 to 1 or more. As good combustion needs an intimate mixture of combustible matter with the oxygen carrying medium, the difficulty is very plain.

Pulverization of coal solves this dilemma. By grinding the fuel to an impalpable powder formed of millions of tiny, microscopic cubes, it becomes easier to surround each small volume of coal by the volume of air required for complete combustion. The contact surface between coal and air is greatly increased by the splitting up into numerous particles of small size. We have only to remember that a 1-in. cube has an exposed useful surface of 6 sq. in. and that the same volume divided in 1000 cubes of 0.1 in. has an exposed area of 60 sq. in., while the same volume split up in 1,000,000 cubes 0.01 in. on a side has an exposed area of 600 sq. in.

The second advantage of pulverization of the solid fuels is the fact that they float in the air, that they spread and that they are carried off by even small air currents. Pulverization having destroyed material cohesion, each microscopic cube of small weight is subjected to the laws and reactions of displaced volumes when mixed with air. This particularity makes the intimate mixture of coal and air very easy; it simplifies the construction of burners and guarantees economical combustion. This can be verified by laboratory tests and is universally acknowledged by the exaggerated fear of powdered coal explosions.

History of the Development

The principles on which the combustion of powdered fuel are based have been known for years. In spite of the recognition of its theoretical advantages and the hundreds of patents of the inventors, the practical results were very discouraging for many decades and commercial success very doubtful. The reason for this anomaly is that the problem is simple only on the surface. A great number of detail questions are implied and their practical solution required many tests and great endurance.

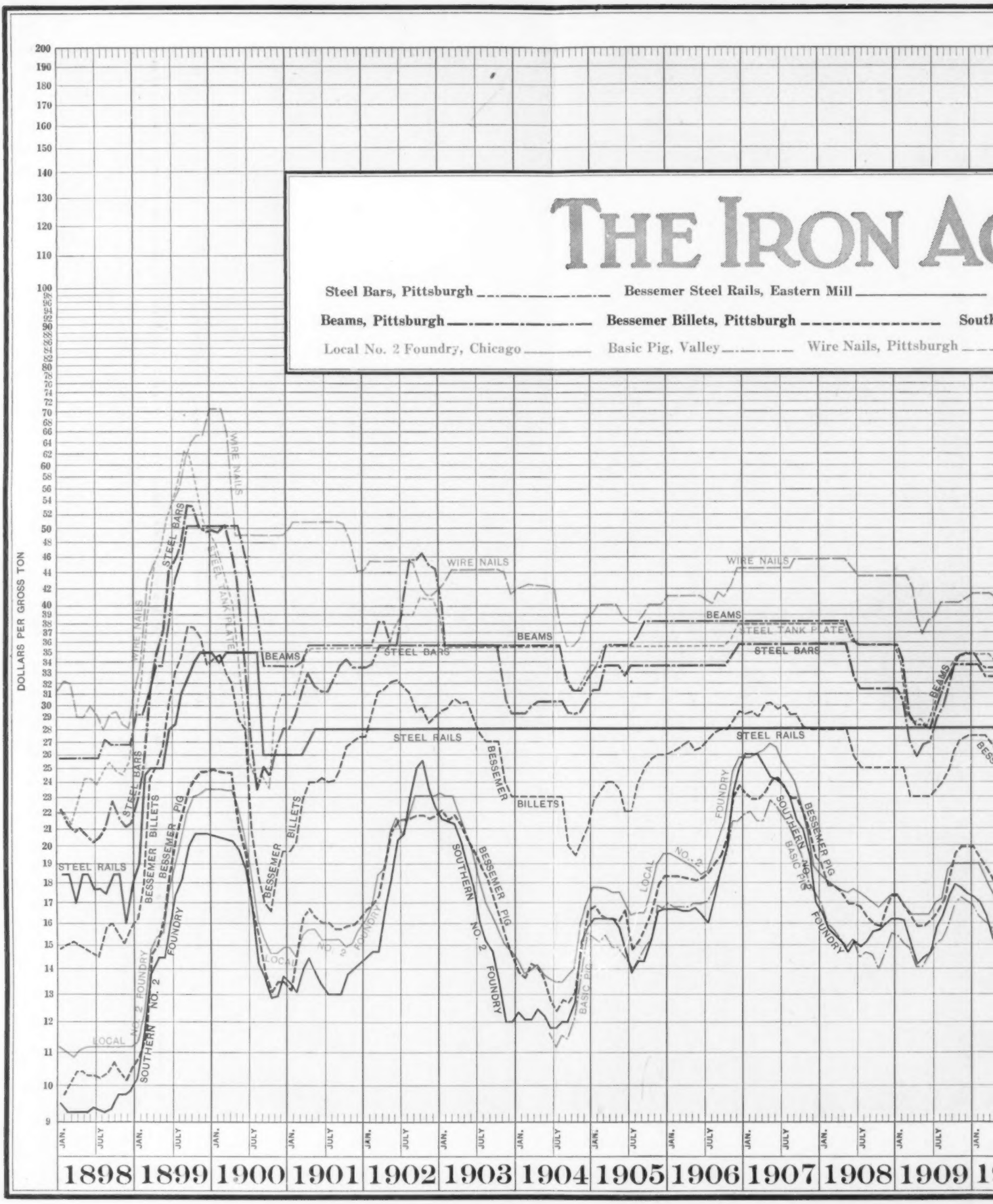
The first successful application of powdered coal was the heating of the rotary kiln in cement manufacture. Hurry and Seaman, of the Atlas Portland Cement Co., have the honor of developing in 1894-1895 this pioneer field where powdered coal rules still today as the most economical fuel (80 to 90 per cent of all the artificial Portland cement of the world being clinkered by powdered coal). We must concede that cement specialists had a great advantage over their competitors because they were familiar with the crushing, grinding and pulverizing of all kinds of materials, a knowledge that formed the key to their ultimate success. The experience gained in the cement industry proved very valuable and the efficiencies recorded induced other industries to investigate that method of burning solid fuels. The first metallurgical installation to give an indication of good results since 1905 was the Lebanon plant of the American Iron & Steel Mfg. Co., now a part of the Bethlehem Steel Co.

Since 1911 the installations burning powdered coal for various industrial uses have increased rapidly so that the practical conditions have become generalized and the required equipment standardized. In 1913 and 1914 two great American engineering societies (Engineers' Society of Western Pennsylvania and the American Society of Mechanical Engineers) held topical discussions on powdered fuel which helped greatly to diffuse the knowledge on the subject and favored considerably the exchange of the experience gained.

Fineness of Grinding

That the early experiment to burn powdered coal failed because the dust was not ground fine enough is well known. No detail problem has had greater bear-

*Copyright, 1920, by Joseph F. Shadgen. The author, who was engaged in the steel industry in Luxemburg at the outbreak of the war, has been practising consulting engineering in New York. A further contribution on powdered coal will go into the details of the equipment, and the observations are those of an engineer-user.



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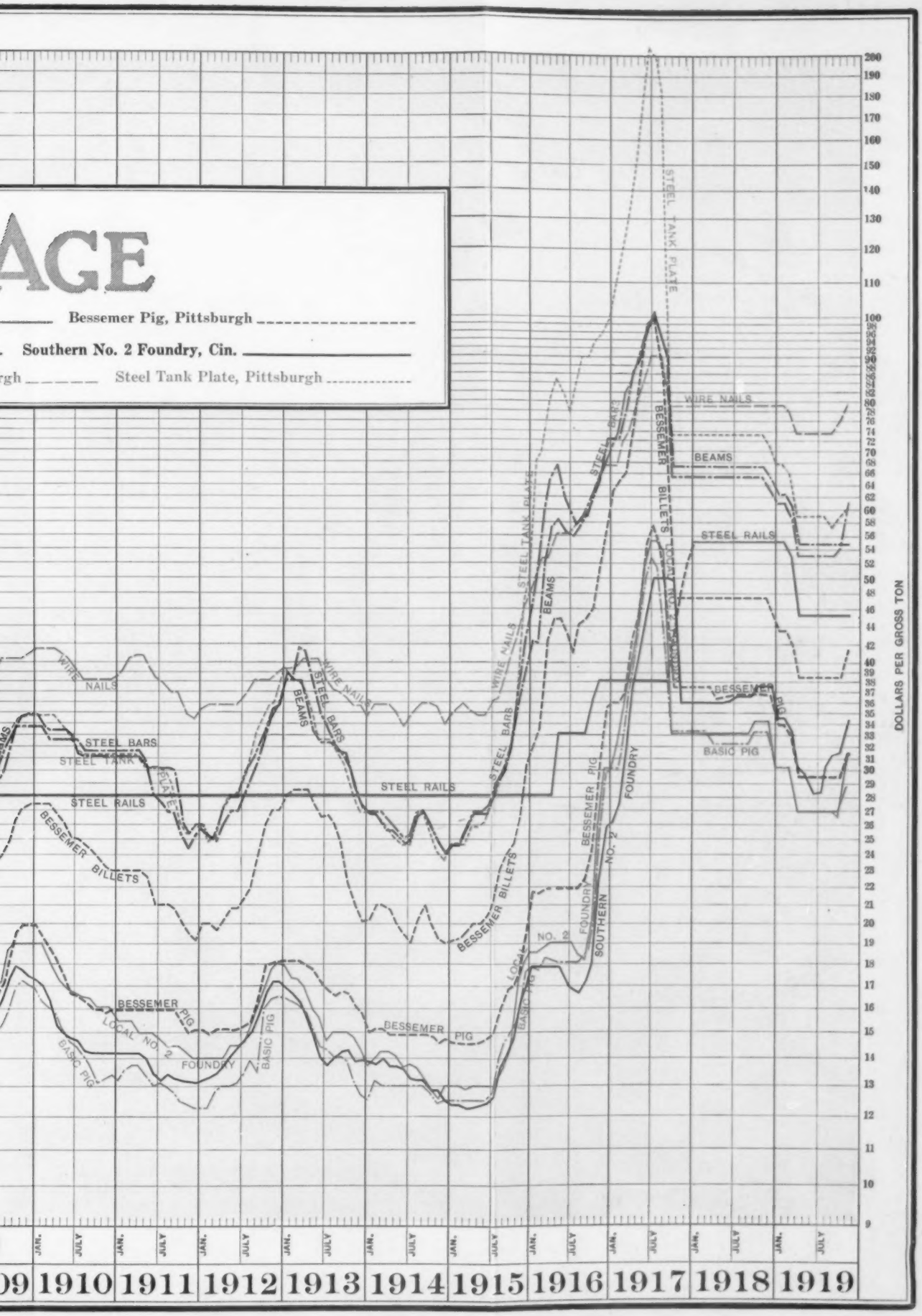


d Iron and Steel from January 1, 1898, to
—Gross Tons

ing on the success of this method of burning coal. There is only one rule to be applied: The finer the coal powder the nearer the ideal conditions for complete combustion are approached. Practically, the cost of pulverization draws the limit to the theoretical desideratum. This limit is not fixed and has a decided tendency to become stricter and more exigent. While in 1914 a coal dust passing 75 per cent through a 200-mesh sieve was considered satisfactory, the experts of 1918 and 1919 agree that it is preferable to have a minimum refuse of 15 per cent on the same sieve.

The paramount importance of the fineness of the coal powder on the efficiency of the combustion, the choice of the pulverizing machinery, the capacity of the plant and last but not least the cost of grinding are reasons aplenty to devote greater attention to this question.

First, what are the sieve standards? The general notions on this subject are mostly confused so that information will be welcome. The Bureau of Standards has worked out specifications for the manufacture of testing sieves legally used in the United States, to assure uniformity of mesh and comparability of results.

In America and England a sieve is characterized by its number of mesh openings per linear inch and a given diameter of phosphor bronze wire, woven carefully uniform and square into a cloth, mounted tight in a brass frame. The frames are shaped so that they can either be nested or telescoped and they are supplied to the trade with covers and pans. In European countries where the metric system prevails sieves are usually characterized by the number of mesh openings per square centimeter (say 400 per sq. cm. or 4900 per sq. cm., etc.) The knowledge of this difference may be useful in the matter of export trade. The accompanying list gives all sieves standard in the United States:

Table I—Standard Sieves for Rating Pulverization

No. of Meshes, per lin. in.	Diameter of Wire, in.	Opening, in.	Opening, mm.
10 x 10	0.035	0.065	1.651
15 x 15	.020	.0465	1.170
20 x 20	.016	.034	.864
30 x 30	.0135	.0198	.503
40 x 40	.010	.015	.381
50 x 50	.009	.011	.279
60 x 60	.008	.0087	.221
70 x 70	.007	.0073	.185
80 x 80	.00575	.0068	.173
90 x 90	.00525	.0059	.150
100 x 100	.0045	.0055	.140
110 x 110	.004	.0051	.130
120 x 120	.0037	.0046	.117
130 x 130	.0034	.0043	.109
140 x 140	.0029	.0042	.107
150 x 150	.0026	.0041	.104
160 x 160	.0025	.0038	.096
170 x 170	.0024	.0035	.089
180 x 180	.0023	.0033	.084
190 x 190	.0022	.0031	.079
200 x 200	.0021	.0029	.074
250 x 250	.0016	.0024	.061
300 x 300	.0015	.0018	.046
350 x 350	.0012	.0016	.042

Second, how is the test to be made? Under what conditions are these standard sieves to be used? What is the preferable diameter for the sieves, 8 in., 10 in. or 12 in.? Is the shaking time unlimited? To what quantity does the test apply?

There are so many variations in the problem that all personal factors have to be excluded to guarantee comparability of results. No trace of these points are found in the numerous publications on the subject. Familiar with other industries dealing with fine powders, the author makes the following suggestion, that may furnish a basis for agreement:

(1) All test sieves used to gage the fineness of powdered coal ought to be 8 in. in diameter.

(2) The sieves used ought to be nested and arranged in sequence, as 90, 100, 150, 200, 250 and 300 mesh, with bottom pan and top cover.

(3) The shaking time ought not exceed 1 minute (and preferably a machine ought to be used).

(4) The amount of coal tested ought to be invariably 100 g. and all results of the scales expressed in grams. Leading inspection engineers ought to work out, with the interested industries and some national engineering society, satisfactory practice along these lines.

Third, there is the question of degree of fineness of the coal powder. Everybody must admit that the refusal of one sieve of given mesh number is a rather vague characteristic of any dust. No real consideration is given to the coarse particles and no account is given of the fine, impalpable part of the powder. The real composition of the fineness of grinding can only be expressed by a sieve test through a sequence of screens of increasing mesh number. The complete result of such test can be computed into an absolute figure called *factor of fineness* reflecting only the composition of powders that are not homogeneously grained.

To illustrate my suggestion by practical examples Table II has been compiled, giving sample tests of four powders. The usual characteristics are given on the top of each test while the amounts of powder caught by each sieve is given in grams in the first column. In multiplying the refusal of each sieve by the corresponding mesh number of the sieve the figures in the second columns are obtained. The dust collecting in the bottom pan (pressing the 300-mesh sieve) is considered having a characterization of 350. The inevitable loss in weight (due to seven or eight weighing operations) is accounted for with a characteristic of 200 as a corrective. In adding all the items of the second column and in dividing the total by 100 we obtain the *factor of fineness*, giving due credit to real composition of the powder. The 90-mesh sieve is merely a check to the upper coarseness of the dust; no refuse ought to be scaled on that sieve.

The author suggests the above factor of fineness because he is convinced of the great future of powdered coal industry. The usefulness of exact comparability will not be denied by anyone. The shortcomings of the suggestion are realized but no absolute ways of comparing can be devised. Co-operation alone can solve this most important point and a plea is made to all interested to come together and work out exact specifications along scientific lines.

That the factor of fineness is not absolute is clearly shown by the above examples. It will vary, and only practical experience can give the limits, all conditions of test being equal. That the factor of fineness will be closely related to the quality of coal used seems evident. The industrial purpose of the combustion of coal will also influence its value. For boilers a certain coal may give best results when ground to 290-300, while the reheating furnace may show highest efficiency with another coal characterized by a factor of 300-320. No investigations have been published dealing with the relative importance of these problems because up to now all efforts have been concentrated upon the immediate commercial success without further considerations. That progress lies in that direction has been amply proved by the development of the art of burning coal powder in the cement industry. To-day by grinding to a greater fineness, economies are realized and efficiencies obtained that seemed impossible in the past.

Necessity of Drying

The necessity of drying the powdered fuel has not been recognized for a long time and the reasons for it do not seem obvious at first sight, especially because in gone-by days—and even to-day—a lot of "practical" engineers moistened their coal before shoveling it on the grates. The grinding expert and manufacturers of flour and powders are, on the other side, able to ad-

vance the most convincing arguments in favor of a thorough dehydration of the fuels. Their prescription, "To produce continuously and economically impalpable powders absolutely dry materials are required," applies to everything, limestone and cement as well as talcum and fuel powders, because absolute dryness avoids the formation of moist, pasty agglomerations, prevents the clogging of screening cloths and sieves, favors the action of air separation and facilitates pneumatic conveying methods. It is usual to-day to dry coal before final grinding so that less than 1 per cent, preferably 0.75 per cent, of water remains in the analysis.

The necessity of drying makes the pulverizing plant more complicated and more expensive and requires power for the motion of the dryer and the running of the fan and heat for the volatilization of the water. But the above mentioned advantages largely outweigh these items and the universal adoption of drying has greatly contributed to the commercial success of this method of burning solid fuels.

The combustion of dry coal gives incidently a better furnace efficiency and a higher flame temperature and lowers the point of ignition which make easier the starting of the fires. These thermodynamic advantages add further weight to the necessity of dryness.

Table II—Determination of Factor of Fineness Illustrated

Sample	A		B		C		D	
Usually Characterised by	10% refuse 100 m. 35% refuse 200 m.		8% refuse 100 m. 25% refuse 200 m.		5% refuse 100 m. 15% refuse 200 m.		3% refuse 100 m. 10% refuse 200 m.	
80	0.0	.....	0.0	.....	0.0	.....	0.0	.....
100	10.0	10x100- 1,000	8.0	8x100- 800	5.0	5x100- 500	3.0	3x100- 300
150	9.0	9x150- 1,350	7.0	7x150- 1,050	4.0	4x150- 600	3.0	3x150- 450
200	16.0	16x200- 3,200	10.0	10x200- 2,000	6.0	6x200- 1,200	4.0	4x200- 800
250	23.0	23x250- 5,750	19.0	19x250- 4,750	14.0	14x250- 3,500	13.0	13x250- 3,250
300	29.0	29x300- 8,700	23.0	23x300- 6,900	26.0	26x300- 7,800	72.0	72x300- 6,600
350	12.0	12x350- 4,200	31.5	31.5x350-11,025	43.5	43.5x350-15,225	53.0	53x350-18,550
Loss (200)	1.0	1x200- 200	1.5	1.5x200- 300	1.5	1.5x200- 300	2.0	2x200- 400
Total.....	100.0	24,400	100.0	26,825	100.00	29,125	100.0	30,350
	Divide by 100 Factor of fineness, 244		Divide by 100 Factor of fineness, 268		Divide by 100 Factor of fineness, 291		Divide by 100 Factor of fineness, 304	

The Matter of Quality of Fuels

Pulverization may be applied to any solid fuel: peat, lignite or bituminous coals of any grade as well as anthracite and coke. All these fuels are burnt successfully in powdered form because the inherent advantages —exact regulation of air and combustible matter plus easy mixture of both—exist at all times under all circumstances. Even vegetable fuel, such as straw refuse and wood chips, have given excellent results after being ground to dust.

Outside of commercial considerations, which are very difficult to consider in a strictly technical report, the immediate industrial purpose and the direct function the combustion has to perform will decide on the quality of the fuel giving best results. Hence each group of industrial applications will have its specific requirements and no general rule, condemning this coal or recommending that one, will be of great value.

Excluding important fields like smelting furnaces and rotary kilns, outside of the iron and steel industry the quality of fuels will have to be discussed separately for boilers; low temperature heating furnaces, such as annealing ovens; high temperature heating furnaces like forge fires and rolling mill furnaces and refining furnaces of which the open hearth is the prototype. The close study of the thermal conditions in each class of industrial furnaces will give very valuable data on the quality of the fuel promising best results.

The quality of a fuel is gaged by the percentage of volatile matter, by the amount of ashes and by the composition of the ashes. The hydrocarbons in a fuel usually influence its point of inflammability and the shape and form of the flame (long or short). The ash content has a great bearing on the cost of pulverization because the mineral impurities are much harder and more gritty than the coal itself. The analysis of the ashes is of importance on account of the fusibility of certain silicates and the effects of sulphur. A priori it seems that pulverization of low-grade fuels with a high ash percentage is greatly handicapped in its overall efficiency because all the power required for the grinding of the useless impurities is lost outright without any chance for recovery.

Carnegie Company's Progressive Policy

The policy which he has attempted to carry out while district superintendent of the Carnegie Steel Co. at Youngstown, Ohio, to establish better relations between the employees and the management, has been outlined by James H. Grose, who retired Dec. 31 to become president of the Brier Hill Steel Co., Youngstown.

Some of the things which have been done and some which will be done are:

Building of homes for the workmen, foreign and native born.

Loaning money to employees at low rates—below that possible to secure at the banks—for the building of homes by the men themselves.

Establishment of schools in which to train men to be foremen and deal with men under them in a way not to cause friction.

Establishment of a bureau to give legal, financial and social advice to the foreigner.

Continuance of the night schools.

Mr. Grose's formula is: Help the workman to help himself. Give him nothing for nothing. Just help him.

"Education of the foreigner is a serious problem," states Mr. Grose. "I am not so sure that the night school is a success or that the foreigner wants it. It takes a good deal of will power to gain an education in a night school. Our experience here has taught us that. Out of 4000 workmen, foreign born or of foreign parentage, we had some 300 in the night school when we started it. It soon dwindled until we had only 27.

"Americanization of the foreigner is possible only when we have educated the American up to the idea of Americanism. It is not the foreigner who is the agitator and leader in these strikes. The foreign organizer is the tool of the American in most cases.

"I believe in helping the foreigner by helping him to help himself. The company, along these lines, is planning more homes for the foreigner, and in fact, for others in its employ, at cost.

"There is also the plan of supplying money to men who want to build their own homes. We have inquired among the men and a large number are anxious to avail themselves of such an opportunity. I would say that 90 per cent of the foreign born are anxious to own their own homes.

"We are about to establish schools in which foremen will be trained to properly handle men. Naturally the foreman is the man who most frequently comes in contact with the workman and upon his tact and diplomacy depends much of the contentment of the men."

Design of Open Hearth Furnaces*

Lack of Rationale in Existing Constructions—Studies Made by Groume-Grjimailo and Others

BY A. D. WILLIAMS

MORE or less mystery has enveloped the designing and construction of metallurgical furnaces. Blueprints with the titles removed and tables of supposedly important features have been carefully treasured. When new furnaces were designed an extensive analysis was frequently made of what was known of the work of others and an endeavor was made to "improve" upon them. During construction visits would be made to other plants and further improvements were frequently made until the finished furnace departed widely from the drawings. Not infrequently the starting up of a new furnace was signalled by an acrid meeting of the lodge of sorrow and expensive reconstruction and loss of product. During the campaign of the furnace the question, "What can be done to change it?" was a live issue. Certain parts of the furnace have to be rebuilt from time to time, and this afforded a certain amount of opportunity to correct early errors, provided they had been rightly diagnosed.

Some years ago the writer became convinced that the flow of gases in a furnace was entirely devoid of mystery, being governed by the laws of elementary physics. Several furnace designers were asked, as the occasion offered, whether they based their design by proportion and experience upon working furnaces or used formulas for the flow of the gases. The replies received were interestingly noncommittal. The physical laws of flowing fluids, however, were found to agree very closely with practical observations. They explained with remarkable clarity some mysterious troubles.

Later the writer got in touch with the work of Professors Groume-Grjimailo and Yesmann. Professor Groume-Grjimailo had gone over the ground very thoroughly several years before the writer had become interested in furnace work, and had conducted numerous experiments with model furnaces. He simulated the flow of the gases and the effects of the atmosphere by immersing his models in water and circulating colored kerosene oil through them, the models being built with glass sides to permit observation.†

A great many illustrations and drawings of furnaces have been printed from time to time with more or less detail. Attention was occasionally called to certain difference, generally some increase in size of certain parts above those of some well-known furnace. The reasons for changes not being stated permitted many inferences to be made.

In designing an open hearth furnace the first point to be settled is the size of the hearth for the furnace. Molten metal weighs 430 lb. per cu. ft., so that 5.23 cu. ft. of bath will be required per ton of metal capacity. The depth of bath permissible depends upon the work to be done. With a shallow bath the reactions will be completed faster than in a deep bath. The boil will be more violent and the depth allowed for the molten cinder will be greater. Furnaces of the mixer type, used in the Talbot and duplex process, are much deeper than those used in the regular process.

In the pig and ore process the boil will increase the volume of the bath to from 2 to 2.5 volumes. In the scrap process the bath may boil to 1.5 to 1.7 its original volume. The manner of handling the cinder, whether it is retained in the furnace until the heat is tapped or is to be drawn off by a cinder skimming notch, affects the depth. In the early furnaces room had to be provided for all of the cinder and overflows were not infrequent. One advantage of the Campbell tilting furnace was the facility it offered for running off a portion of a heavy cinder. Later furnaces were built with a cinder notch which permitted draining any excess amount of cinder.

Table I gives the approximate hearth area in square feet required for bath depths ranging from 1 to 3 ft. It was computed by the formula:

$$3\ V/d = A$$

In which: V = volume of molten metal in charge;
d = depth of bath, metal only;
A = area of hearth.

While it is necessary to provide additional depth to cover the depth of cinder and the boiling of the charge, additional area is not required for these purposes.

An old rule of thumb made the length of the furnace twice its width. This was all very well with small furnaces, although a longer hearth gives better combustion conditions. The temperature of the metal in the bath is between 1525 and 1600 deg. C. The cinder will be slightly hotter than the metal, the difference ranging from a few degrees just previous to tapping, to 100 deg. or more. The gases leaving the hearth will range between 1600 and 1700 deg. Told states that the gases should remain in the hearth 2 sec. Groume-Grjimailo, that the temperature drop through the hearth should be assumed as 200 deg. C. per sec. The theoretical flame temperature of a very good producer gas with both the air and the gas preheated to 1000 deg. and 40 per cent excess air will be between 2100 and 2140 deg.

These data would seem consistent. It requires between one and two seconds for the reaction of combustion to be completed as the large jets of air and gas from the ports must be given time to mix. With too short a furnace the flame will extend beyond the hearth. With too long a furnace the gases of combustion will tend to drop below the bath temperature.

There are three limitations on the width of the furnace:

1. The distance material can be thrown through the door by expert manipulation of a shovel.
2. The width the flame can be spread.
3. The limitation due to the strength of the roof.

The first controls patching and making bottom. Furnaces have been built 16.75 ft. wide. This is rather close to the limit.

Table II gives the hearth dimensions of a number of furnaces in service. It shows a considerable diversity in the ideas regarding this portion of the furnace. Table III gives the minimum and maximum values from Table II.

The diagrams, Figs. 1, 2, 3 and 4 show, respectively the approximate depth of bath in feet; the length of the hearth in feet; the width of the hearth in feet and the area of the hearth in square feet. Two lines have been plotted on these diagrams, showing the dimensions

*Copyrighted, 1919, by A. D. Williams.

†Essai d'une Théorie des Fours à Flammes by W. E. Groume-Grjimailo, professor of iron manufacturing at the Polytechnic Institute of Petrograd.

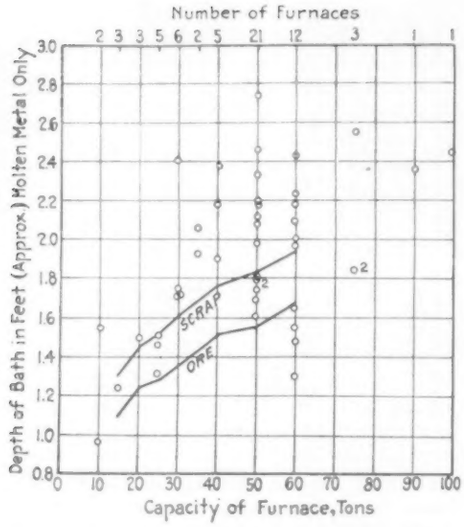


Fig. 1.—Graphical Comparison of the Approximate Depth of Molten Metal in Bath of Open Hearth Furnaces.

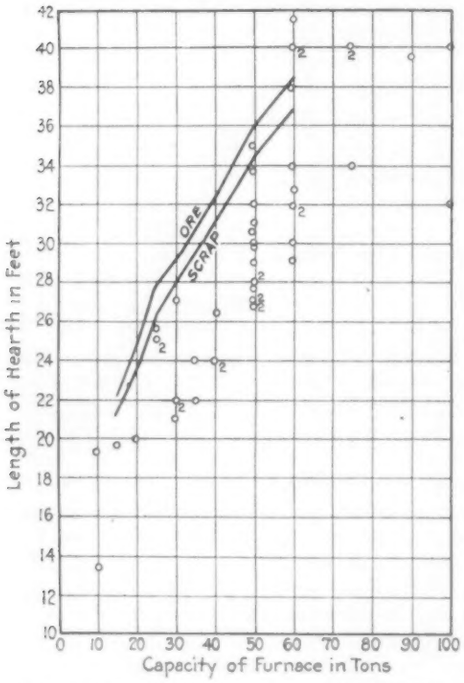


Fig. 2.—Graphical Comparison of the Length of Hearth in Various Open Hearth Furnaces

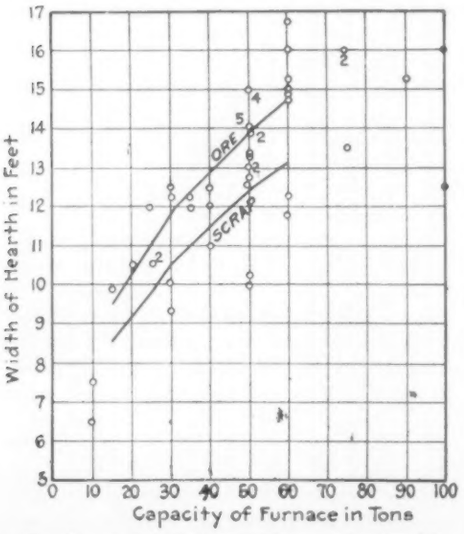


Fig. 3.—Graphical Comparison of the Width of Hearth in Various Open Hearth Furnaces

Table I—Hearth Area of Open-hearth Furnaces for Various Depths of Mol en Metal

Capacity of Furnace, Tons	Cu. Ft. of Molten Metal	Depth of Bath of Molten Metal, In. 12	15	18	21	24	27	30	33	36
		(Hearth area in square feet)								
15	78.45	235	188	157	135	118	..	..	..	..
20	104.60	314	252	212	180	157	139	..	..	..
25	130.75	392	314	262	225	196	174	..	..	..
30	156.90	471	376	314	270	235	209	189	..	..
35	183.05	549	440	356	316	275	244	220	201	..
40	209.20	628	504	420	360	314	278	256	229	209
50	261.50	785	629	525	450	392	350	325	286	262
60	313.80	941	755	629	542	471	418	377	343	314
75	392.25	1177	940	785	674	588	523	470	429	392
90	470.70	1412	1130	945	812	706	628	567	515	471
100	523.00	1569	1255	1050	900	785	697	629	573	523

Allow from 3 to 6 in. for cinder and boil.

Formula: $3\ V/d=A$. In which: V=Volume of molten metal in charge; d=Depth of bath; metal only; A=Area of hearth required. Weight of molten metal, 430 lb. per cu. ft.; 5.23 cu. ft. per ton.

Table II—Hearth Data of Open-hearth Furnaces from Practice

Tons	Reference Number	Length, Ft. L	Width, Ft. W	Area, Sq. Ft. A	L/W	A/Tons	$3\ V/A$
10	01-A	19.25	6.50	163.6	2.96	16.36	0.95
10	02-F	13.50	7.54	101.0	1.82	10.12	1.59
15	01-GS	21.32	8.52	181.0	2.50	12.06	1.31
15	02-GO	22.37	9.57	215.0	2.33	14.35	1.10
15	03-B	19.67	9.83	191.7	2.00	12.78	1.23
20	01-GS	23.45	9.18	215.3	2.56	10.75	1.46
20	02-GO	24.61	10.33	254.0	2.39	12.70	1.24
20	03-A	20.00	10.50	210.0	1.92	10.50	1.50
25	01-GS	26.25	9.84	258.4	2.67	10.30	1.52
25	02-GO	27.87	11.07	304.6	2.53	12.20	1.29
25	03-A	25.00	10.50	262.5	2.38	10.50	1.49
25	04-A	25.00	12.00	300.0	2.08	12.00	1.31
25	05-A	25.63	10.50	268.0	2.44	10.70	1.46
30	01-GS	27.89	10 50	290.6	2.63	9.6	1.62
30	02-GO	29.20	11 81	344.5	2.48	11.4	1.36
30	03-B	21.00	9.30	195.0	2.26	6.5	2.41
30	04-A	22.00	12.5	275.0	1.77	9.17	1.71
30	05-A	21.88	12.25	267.9	1.77	8.93	1.76
30	06-B	27.00	10.00	270.0	2.70	9.0	1.75
35	01-A	24.00	12.00	288.0	2.00	8.20	1.92
35	02-A	21.87	12.25	267.0	1.79	7.62	2.06
40	01-GS	31.00	11.48	355.0	2.70	8.85	1.77
40	02-GO	32 41	12.89	417.7	2.52	10.50	1.51
40	03-F	24.00	11.00	264.0	2.20	6.60	2.38
40	04-A	26.33	12.50	329.0	2.11	8.23	1.90
40	05-A	24.00	12.00	288.0	2.00	7.20	2.18
50	01-GS	34.45	12.46	430.6	2.77	8.6	1.83
50	02-GO	35.96	13.98	502.7	2.58	10.0	1.56
50	03-A	32.00	10.00	320.0	3.20	6.4	2.46
50	04-A	27.00	13.9	376.	1.96	7.5	2.08
50	05-A	29.75	15.00	446.0	1.99	8.90	1.76
50	06-A	32.00	14.00	448.0	2.28	8.96	1.75
50	07-A	30.00	15.00	450.0	2.00	9.00	1.74
50	08-A	30.50	13.00	396.5	2.36	7.92	1.98
50	09-A	31.00	15.00	465.0	2.08	9.30	1.68
50	10-A	28.00	12.75	357.0	2.20	7.14	2.20
50	11-A	31.00	14.00	434.0	2.22	8.58	1.81
50	12-A	35.00	14.00	490.0	2.50	9.80	1.60
50	13-A	26.75	13.40	361.1	2.00	7.20	2.18
50	14-A	27.67	13.30	368.7	2.08	7.38	2.12
50	15-A	26.75	12.58	336.5	2.12	6.73	2.33
50	16-A	32.00	14.00	448.0	2.28	8.96	1.75
50	17-A	27.00	13.90	375.8	1.95	7.50	2.08
50	18-A	29.00	15.00	435.0	1.95	8.70	1.80
50	19-A	32.00	14.00	448.0	2.28	8.96	1.75
50	20-A	33.67	13.00	438.0	2.59	8.76	1.79
50	21-F	28.00	10.25	287.0	2.73	5.74	2.74
60	01-GS	36.75	13.12	484.4	2.80	8.1	1.95
60	02-GO	38.39	14.76	566.2	2.60	9.3	1.68
60	03-A	30.00	15.00	450.0	2.00	7.5	2.09
60	04-A	38.00	15.00	470.0	2.54	9.5	1.65
60	05-A	43.00	16.75	720.0	2.55	12.0	1.30
60	06-A	40.00	16.00	640.0	2.50	10.67	1.47
60	07-A	34.40	12.30	423.0	2.80	7.05	2.23
60	08-B	32.75	11.80	387.0	2.77	6.45	2.43
60	09-A	32.00	14.75	472.0	2.18	7.67	2.00
60	10-A	29.00	14 92	432.0	1.94	7.20	2.18
60	11-A	40.00	15.25	610.0	2.63	10.16	1.54
60	12-A	32.00	15.00	480.0	2.13	8.00	1.96
75	01-A	40.00	16.00	640.0	2.50	8.53	1.84
75	02-A	34.00	13.50	460.0	2.53	6.14	2.56
75	03-A	40.00	16.00	640.0	2.50	8.53	1.84
90	01-A	39.50	15.25	600.0	2.56	6.67	2.36
100	01-A	40.00	16.00	640.0	2.50	6.40	2.45
100	02-F	32.00	12.50	400.0	2.55	4.00	3.92
150	01-A	41.00	15.00	615.0	2.74	4.06	3.83
200	01-A	42.00	15.75	665.0	2.66	3.32	....
200	02-A	40.00	16.00	640.0	2.50	3.2	....
200	03-B	47.20	13.00	616.0	3.64	3.08	....
200	04-A	40.00	13.00	520.0	3.07	2.60	....
300	01-B	47.20	14.75	695.0	3.19	2.32	....

A=American. F=Foreign. B=Boche (German-Hungary, etc.)
GS=Groume-Grjimailo scrap process.
GO=Groume-Grjimailo ore process.

Table III—Maximum and Minimum Values from Table II

Tons Capacity	Length, Ft. Min.	Max.	Width, Ft. Min.	Max.	Area, Sq. Ft. Min.	Max.	L/W Min.	Max.	A/Ton Min.	Max.	3 V/A Min.	Max.
10	13.50	19.25	6.50	7.54	101.0	163.6	1.82	2.96	10.12	16.36	0.96	1.55
15	19.67	22.37	8.52	9.83	181.0	215.0	2.00	2.50	12.06	14.35	1.10	1.31
20	20.00	24.61	9.18	10.50	210.0	254.0	1.92	2.56	10.50	12.70	1.24	1.50
25	25.00	27.87	9.84	12.00	262.5	304.6	2.08	2.67	10.30	12.20	1.29	1.52
30	21.00	29.20	9.30	12.50	195.0	344.5	1.77	2.70	8.93	11.40	1.36	2.41
35	21.87	24.00	12.00	12.25	267.0	288.0	1.79	2.00	7.62	8.20	1.92	2.06
40	24.00	32.41	11.00	12.89	264.0	417.7	2.00	2.70	6.60	10.50	1.51	2.38
50	26.75	35.96	10.00	15.60	287.0	503.7	1.95	3.20	5.74	10.00	1.56	2.74
60	29.00	43.00	11.80	16.75	387.0	720.0	1.94	2.80	6.45	12.00	1.30	2.43
75	34.00	40.00	13.50	16.00	460.0	640.0	2.50	2.53	6.14	8.53	1.84	2.56
90	...	39.50	...	15.25	...	600.0	...	2.56	...	6.67	...	2.36

Table IV—Open Hearth Furnace Hearth and Heating Chamber Proportions, According to Groume-Grjimailo

Capacity, Tons	Scrap Process: Length, Ft.	Width, Ft.	Area, Sq. Ft.	Height Above Bath, Ft.	Ore Process: Length, Ft.	Width, Ft.	Area, Sq. Ft.	Height Above Bath, Ft.	Heating Chamber, Cu. Ft.
15	21.32	8.52	181.7	5.25	22.57	9.57	215.3	4.43	954
20	23.45	9.18	215.3	5.91	24.61	10.33	254.0	5.00	1271
25	26.25	9.84	258.4	6.15	27.55	11.07	304.6	5.21	1581
30	27.89	10.50	290.6	6.56	29.20	11.81	344.5	5.53	1907
40	31.00	11.48	355.2	7.56	32.41	12.89	417.7	6.09	2543
50	34.45	12.46	430.6	7.15	35.96	13.98	502.7	6.32	3178
60	36.75	13.12	484.4	7.87	38.39	14.76	566.2	6.73	3814

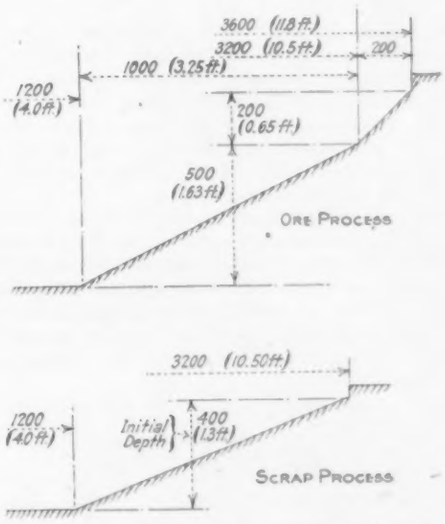


Fig. 5.—Sections Showing Profile of Hearth Slope According to Prof. Groume-Grjimailo

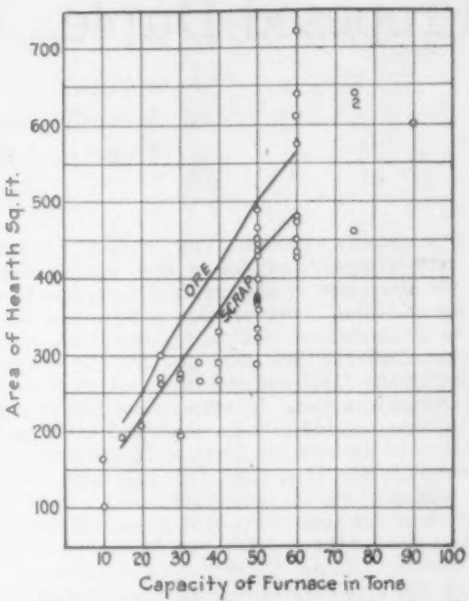


Fig. 4.—Graphical Comparison of the Hearth Area of Various Open Hearth Furnaces

of the furnaces given in Table IV, which was abstracted from Professor Groume-Grjimailo's paper, in the Journal de la Société Russe de Métallurgique. This table was given in THE IRON AGE of Dec. 26, 1917.

Fig. 5 shows the profile of one side of the hearth suggested in this paper for a 30-ton furnace. These furnace hearths show a certain consistency in their design, a larger hearth and a shallower bath being suggested for the ore process than for the scrap process.

(To be continued)

Steel Wheels for Motor Cars

That steel wheels for motor cars are coming to the fore, especially abroad, was evidenced by the cars exhibited at a recent show at Olympia, England. Statistics furnished by *Engineering*, London, show that out of 271 cars, detachable steel spoke wheels were adopted on about 35 per cent of the cars, wire detachables accounted for 22 per cent, steel disk detachable wheels for 18 per cent and wood detachables for nearly 7 per cent; the total of detachables thus being 82 per cent. Wood non-detachable wheels were adopted on only 12 per cent of the cars.

A steel wheel of new design was exhibited by W. Goodyear & Sons, of Dudley. This wheel is in the form of a corrugated disk, which is, of course, rigid and also, it is claimed, less likely to get out of true than a flat disk design.

A Blueprint Protector

A blueprint protector of simple construction and low cost, to prevent prints from becoming dirty, wet, greasy or torn while being handled by workmen, may be made with a sheet or transparent sheeting—the same material used for lights in auto curtains—cut to desired size. A piece of lightweight leather substitute is then cut about ½ in. larger all around than the piece of sheeting. This extra half inch allows for a lap-over on all but the top side of the protector. A sewing machine stitches the lap down to the sheeting forming a large flat pocket, open at the top for the insertion of the blueprints. Both the transparent front and the coated fabric back are waterproof and greaseproof. Dirt or grease may easily be wiped or washed off either surface without injury to the material. Both materials are flexible and the holder may be rolled up if desired in the same way an unprotected blueprint is usually handled by a workman.

Safety Council Provides for Code Uniformity

At the conference of the National Safety Council, called by the Bureau of Standards and held at Washington, D. C., Dec. 8 and 9, discussion was held concerning the conflicting safety codes in existence, formulated by State, insurance and other organizations, and the resulting evils from this lack of uniformity. Approval was given the plan of formulating safety standards under the auspices of the American Engineering Standards Committee, composed of representatives of five engineering societies and three Government departments. It recommended that a general advisory committee should be formed to include representatives of all national associations, State commissions, and others, to survey the entire field of safety standards and recommend what standards should be undertaken and what organizations should sponsor them.

Compressed Canvas Cushion Wheels

Wheels with flanges and treads made of canvas duck compressed radially are being marketed by Divine Brothers Co., Utica, N. Y. The manufacturer states that during the war, mine cars were equipped with these wheels because of their silent running, for tunneling into the enemy's camp. The flanges were required as the wheels ran on wood stringers.

The wheels with or without flanges are made for use on various kinds of factory trucks such as hand trucks, power trucks, elevating trucks, tractors and trailers. The same form of construction is used by this company for special pulleys, sheaves, paint rolls and other applications.

Proposed Duplex Process for Making Steel

Apparatus Calculated to Minimize Losses of Metallic Iron in the Slag and Ejected as Dust and Splashes—Cost Comparisons

BY G. L. FISK*

IT is generally conceded that the duplex process is a more expensive method of steel making than either the Bessemer or the straight open hearth process. In many places, however, this feature has been offset by local conditions making the combined process advisable. Inferior ore coke and scarcity of scrap are probably the chief considerations which have fostered the duplex practice. In other cases this practice may have been resorted to as a means for utilizing the full capacity of an existing Bessemer plant with decreasing demand for Bessemer steel, or it may have been adopted for intermittent or temporary use to vary the production of the steel plant with changing market conditions. Limited room for expansion might also turn the scales in favor of the combined process.

In the case of inferior raw materials it is difficult to make iron suitable for either the acid Bessemer or the basic open hearth. Bessemer iron must be low in sulphur and its silicon content should be nearly constant. It is essential in making Bessemer steel of good quality that the casting temperature be right. Silicon being the chief source of heat, any variation in the content of this element will tend to vary the temperature of the blow. The use of a mixer will lessen the variation in silicon content and the difficulty is through this medium lessened but not done away with.

Basic iron for the open hearth process should as nearly as possible be free from silicon and sulphur, as the removal of sulphur on the basic hearth is slow and costly, and the silica resulting from the oxidation of silicon corrodes the furnace lining and lessens the basicity of the slag, thus interfering with the removal of both phosphorus and sulphur. To comply with these limitations for Bessemer or basic iron is often a difficult task even with suitable raw materials, because the conditions in the blast furnace which tend to reduce the sulphur also tend to raise the silicon in the iron.

In the duplex process, on the other hand, the silicon content of the iron becomes relatively unimportant. This fact simplifies the operation of the blast furnace in that it need not be closely restricted as to the control of silicon and all attention can be given to the reduction of sulphur. This impurity can best be gotten rid of in the blast furnace; it cannot be reduced in the acid converter and its reduction in the open hearth furnace entails extra expense and long operation. The carbon and silicon in the iron can most readily be removed by air blast, which will subsequently shorten the time in the open hearth furnace, reduce the wear on the bottom material and decrease the cost of repairs and refractories.

The use of scrap, so necessary to the straight open hearth process, is not required in the duplex process. This is a point of decided advantage and in some cases even a deciding factor in favor of duplexing. As a matter of course, the combined method is also independent of the low phosphorus ores, so essential to the straight Bessemer process.

Broadly speaking, therefore, the duplex process is preferable to both those of the Bessemer and open hearth, and the high cost is probably the only reason why this combined process has not been universally adopted to simplify and standardize production in the blast furnace as well as in the steel plant. The straight Bessemer is and probably will continue to be the cheapest method of making steel, but its product has a limited demand only, whereas the product of the duplex method is practically on a par with that of the straight open hearth process.

High Metallic Loss of Duplex Method

The high cost of the combined method is due to the great metallic loss which results in a high increment cost. To use representative figures we must assume a metallic loss of 7 per cent in the converter plus 5 per cent in the open-hearth furnace in the case of duplexing as against an 8 per cent metallic loss in the straight open hearth process. On the other hand, the increased production per unit obtaining with the duplex process results in a lower operating cost. The repeated handling of the metal, however, in this process requires the use of considerable labor, power, machinery and equipment and the saving in the operating cost as compared to the straight open hearth process is usually too small to offset materially the loss accruing from the higher increment cost. In the past it has been accepted as a foregone conclusion that these conditions could not be materially improved upon. Let us see if this assumption is warranted.

The product of the blast furnace is refined into steel by removing the impurities in the iron. In doing this, however, a quantity of metallic iron goes to waste. The removal of metalloids with the attending loss of metallic iron will, of course, lessen the total weight of the metal treated and result in increased cost of refined metal per unit of weight. This increase in cost of metal is termed the increment cost.

The purely chemical reactions which form the basis for the open hearth process entail a loss of metallic iron which we do not presume can be materially decreased. In the Bessemer converter, on the other hand, a portion of the loss of metallic iron is due to the mechanical effect of the blast, and this loss, the author believes, can be eliminated. The loss in the converter is made up about as follows:

Oxidation of metalloids.....	4.75 per cent
Metallic iron ejected from mouth of converter as dust and splashes...	.50
Metallic iron shot in slag.....	.50
Metallic iron combined in slag.....	1.25
Total converter loss in duplexing..	7.00 per cent

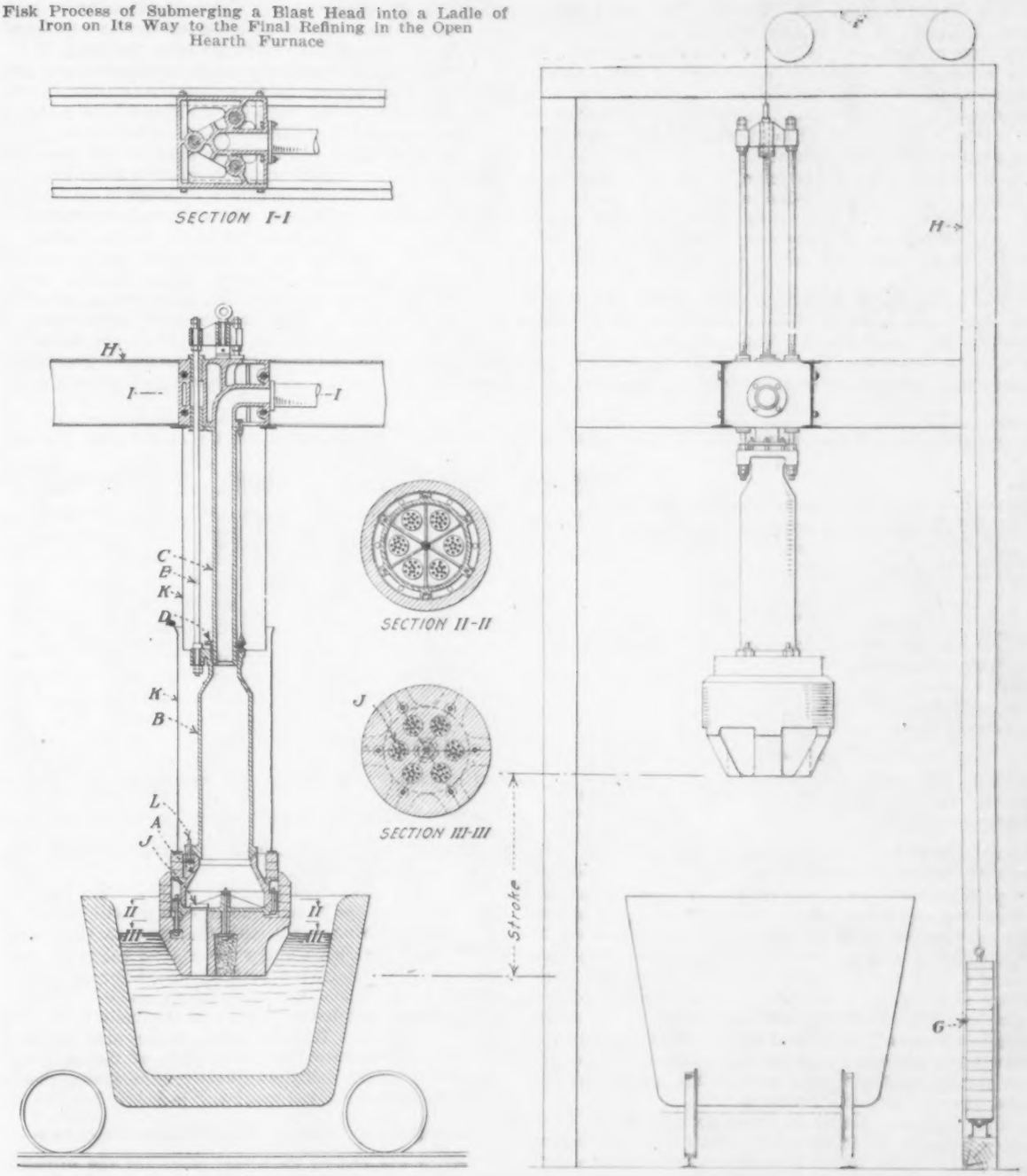
The loss of 4.75 per cent metal due to the oxidation of metalloids will, of course, remain the same irrespective of the method of refinement. There remains to be accounted for a loss of 2.25 per cent of metal due to loss of metallic iron. On account of the high wind pressure necessary in the Bessemer converter to prevent the iron from running into the tuyeres, a quantity of slag and particles of metallic iron are thrown out through the converter mouth by the force of the blast. This results in a waste of 0.50 per cent of the metal blown. Other particles of metallic iron carried off by the blast will be caught in the slag of the bath and remain mechanically held. This iron, which represents another 0.50 per cent of the metal, could later be recovered by crushing the slag and passing it over a magnetic separator, but this is a rather expensive procedure. The remainder of the loss of metallic iron is due to the oxidizing effect of the blast and amounts to 1.25 per cent of the metal blown. The oxide of iron thus formed becomes a component part of the slag.

Method for Minimizing Loss

From this brief study of the causes of metallic loss it would certainly appear that a portion could be avoided. Let us assume we invert the blast and blow down through the metal from tuyeres submerged in the bath. The air blown into the bath must then reach a turning point where the force of the blast has been expended and from this point it must rise without initial velocity. No metallic iron, therefore, can be thrown out of the vessel containing the metal and little or none should be carried into the slag by the force of the blast. With this idea in mind the author has designed a blast apparatus for blowing down into the metal, introducing the air below the surface of the bath. This

*Chief engineer, Central Iron & Steel Co., Harrisburg, Pa.

Fisk Process of Submerging a Blast Head into a Ladle of Iron on Its Way to the Final Refining in the Open Hearth Furnace



apparatus, suspended from a superstructure over the hot metal track, will permit of preliminary refining of the metal in the very ladle in which it is taken to the open hearth for finishing into steel. This method of procedure has been patented and, for distinction from the ordinary duplex process, it will be termed the Fisk process.

It may be argued that the idea of blowing down into the metal is anything but new. As a matter of fact, it was tried in the early history of the Bessemer process, but failed to yield a satisfactory product. The object in those days was to blow a finished steel and, furthermore, the means employed were very crude. In the Fisk process the inverted blast is intended for preliminary work only and the lack of uniformity of the product is of minor consequence. Proposals of later date to employ the inverted blast as a refining medium have met with constructive difficulties and proposed applications of air blast have been such as to interfere with the practical working and handling of the metal. The injection of air directly into the open hearth bath, for instance, would interfere with the process, complicate operations and entail difficulties of construction.

The Apparatus

The accompanying illustrations show a Fisk blast apparatus designed for blowing a 30-ton heat in half an hour. The blast head **A** is attached to the blast box **B**, which latter is movable up and down over the stationary blast tube **C**. A stuffing box **D** provides an air-tight fit between the movable blast box and the stationary tube. The blast head and blast box, together with the guide rods **E**, are suspended by a chain or steel cable **F** and counterbalanced by weight **G**. The entire apparatus is carried by a structural framework **H**.

When not in operation the blast head is held in its highest position by the counterweight, which is of sufficient weight to balance all moving parts of the apparatus and to overcome the frictional resistance in raising. In its uppermost position the blast head is high enough to give sufficient train clearance on the hot metal track below. The apparatus has six tuyere bricks **J**, which are identical with those used in the Bessemer converter. Special brickwork protects the tuyeres and nose of the blast head, and a telescoping guard **K** keeps the machined outside surface of the blast tube free from dust. To facilitate removal and exchange, the blast head is made quickly detachable from the blast box to which it is held by bolts **L**.

Air admitted to the apparatus from the blast line

M will escape through the tuyeres. The small tuyere area, however, in its relation to the capacity of the blast line creates a pressure inside the blast head. As this pressure increases the resistance of the counterweight and friction is overcome and the head forced into the metal in the ladle placed underneath the apparatus as shown in the figure. The greater the blast pressure the greater the depth to which the head will be forced into the metal. The submersion in the bath being contingent upon the blast pressure eliminates the danger of iron running into the tuyeres. When the blast is shut off the decreasing air pressure permits the counterweight to pull the head out of the bath to its original position.

The use of the Fisk process should be a simple matter when one or more of these apparatuses are provided over the hot metal track. The metal from the mixer or directly from the blast furnace is tapped into ordinary iron ladles on trucks. It will, of course, be necessary to provide a suitable lining in the ladles to withstand the chemical action of the bath. The iron ladles are pulled away from the mixer or the blast furnace by a locomotive or other means of conveyance and placed in a position for blowing. In case several ladles are to be handled at a time, the blast apparatuses should be spaced to suit the length of the ladle trucks and thus reduce shifting to a minimum. The blowing of the metal can be hurried or retarded according to conditions in the open hearth, and as the metal is ready the ladles are transferred to a suitable location from where they can be handled by the open hearth cranes and the metal charged into the furnaces.

The six tuyere bricks shown in the figure each have twelve holes ½ in. in diameter, making a total tuyere area of 14.1 sq. in., which applied to a 30-ton bath would mean 0.47 sq. in. tuyere area per ton of metal. In straight Bessemer practice the tuyere area usually varies from 2 to 2½ sq. in. per ton charge and a heat is blown in about 9½ min. If we assume that as much air of a fixed pressure is required for duplexing with the Fisk process as is needed in the straight Bessemer process it would take

$$9.5 \times \frac{(2+2.5)}{2} \times \frac{1}{0.47} = 45 \text{ min.}$$

to treat 30 tons of metal with a Fisk apparatus of 14.1 sq. in. tuyere area. But experiments have indicated an air consumption in the converter as high as twice the quantity theoretically required for the oxidation of the metalloids, which circumstances must be due to the short and rapid travel of the air through the metal. With the Fisk apparatus the blast should be more fully utilized. By blowing down into the metal and compelling the air to float back to the surface we both lengthen the travel and slow down the speed of the air through the metal, thus increasing the time of contact between the air and the metal, and reducing the cooling effect of surplus air. The author figures, therefore, that it should be possible to blow 30 tons of metal in 30 min. with his apparatus. The design of the blast head can, of course, be modified to increase or decrease the number and size of tuyere openings to suit whatever blast pressure may be found most practical.

It will not be necessary to generate as much heat with the Fisk process as is customary in case of ordinary duplexing. The reduced handling of the metal in the Fisk process does away with the heat loss in pouring the metal from one vessel to another and also that incurred due to the heating of more than one vessel. The cooling effect of surplus air should also be very much reduced for reasons already given. With Fisk apparatuses the preliminary refining can be carried on close to the open hearth furnaces and this is not always possible in the ordinary duplex process which requires repeated handling of the blown metal and often a transfer of it over long distances. Furthermore, if necessary, the ladle can be insulated to cut down the heat loss due to radiation to a minimum. Everything considered it would seem entirely feasible to maintain a sufficiently high temperature for the successful working of the proposed process.

With the downward direction of the blast and the limited size of the blast head, the bath will be set in circulation, moving down with the blast in the center of the ladle and rising along the wall of the ladle. By thus establishing a fixed path of travel for metal, air and gases the violent ebullition taking place in the converter should not be so evident in the ladle used with the Fisk process. The circulating action also makes it possible to penetrate the entire body of the bath and the desiliconizing and decarburizing, therefore, should be fairly uniform throughout the metal.

Comparative Costs† of Steel Manufacture by the Straight Open Hearth, the Ordinary Duplex and the Fisk Duplex Processes

	Preliminary Bessemer	Process Fisk	Finishing Process Open Hearth	Straight Open Hearth	Bessemer O.-Hearth Duplex	Fisk Open Hearth Duplex
Capital investment for a production of 50,000 tons per month	$750,000	$250,000	$2,500,000	$5,000,000	$3,250,000	$2,750,000
Capital investment per ton of monthly production	15	5	50	100	65	55
Yearly amortization for 20 years at 6 per cent	20,385	6,795	67,950	135,900	88,335	74,745
Metallic loss, per cent	7	6	5	8	11.65	10.7
Costs per gross ton:						
Interest on investment	.075	.025	.25	.50	.325	.275
Amortization	.035	.01	.13	.26	.165	.14
Increment with iron at $30 per ton	2.26	1.91	1.69*	2.61	3.96	3.59
Operating labor	.33	.11	1.44	1.91	1.77	1.55
Operating expense, including power, water, tools, etc.	.41	.26	.40	.45	.81	.66
Repairs	.10	.08	.79	.90	.89	.87
Refractories	.11	.11	1.03	1.33	1.14	1.14
Gas coal, at $3 per net ton	...	...	.60	.90	.60	.60
Molds and Stools	...	...	.22	.22	.22	.22
Overhead expense	.07	.07	.20	.29	.27	.27
Total cost, per gross ton	3.39	2.575	6.75	9.37	10.15	9.315

*The increment cost for the open hearth finishing process actually figures $1.70 per ton for Bessemer metal and $1.68 for Fisk metal. †Cost of recarburizer not included.

Comparative Costs of Steel Making Processes

Basing his figures on actual costs for the ordinary duplex and straight open hearth processes the author has made an attempt to estimate the relative costs of steel manufacture by the different methods under consideration. The tabulation of results is self-explanatory.

As compared to the ordinary duplex process the preliminary refining of the metal in the Fisk process should be very much cheaper. Assuming that the metallic loss can be reduced from 7 to 6 per cent, for reasons stated above, this item alone would represent a saving of about 35c. per ton of steel with iron at $30 per ton. But there are reasons to expect a still greater saving in the cost of operation, as the reduced handling of metal, simplified operation and the absence of electric cranes and hydraulic machinery must result in a considerable saving in operating labor, repairs, maintenance and power.

The effect of plant amortization and interest on the cost of the steel is another item in favor of the Fisk process. Aside from mixer, blowing engines and repair house for the noses of the blast heads the cost of installation for the preliminary treatment will be small. One complete blast apparatus, as shown in the figure, for a capacity of 30 tons of metal per half hour would weigh only 10,000 lb. exclusive of brickwork and counterweight. The brickwork as shown figures 465 9-in.

equivalent. The cost of the blast apparatus, therefore, would be almost a negligible factor.

The author believes a total saving of 85c. per ton could be effected with iron at $30 through the use of the Fisk process as opposed to the customary duplex process. This should bring the cost of the combined process to a level where it would become a dangerous rival to the straight open hearth process on the basis of cost per ton alone. In addition to this should be considered the small investment with the Fisk process and the small space required per ton capacity, the flexibility of production, the feasibility of using inferior raw materials, the independence from scrap, the simplified blast furnace operation and the opportunity of materially increasing the production of an existing open hearth plant on short notice and at small cost.

It would seem reasonable to assume that any practical obstacles to the Fisk process can be successfully overcome. Provided, therefore, that the above reasoning is correct, or nearly so, the proposed method of steel making should solve many perplexing problems and offer attractive opportunities for investment.

German Steel Prices Still Soaring

Fresh Advances of 800 to 1100 Marks Per Ton — Demand is Heavy, But Scarcity of Ore and Coal Seriously Hampers Operations

(Special Correspondence)

BERLIN, GERMANY, Dec. 6.—The most interesting event since my report of Oct. 28 was a sharp advance in prices last week. As foreshadowed in that report a further raise was to be expected. Indeed, it became a certainty by the middle of November. The only question was how great it would turn out to be. It was at first expected that a raise of 400 to 500 marks a ton on the various classes of steel products would be made; but the advances actually adopted on Nov. 25 were twice as great, being over 1000 marks on plates. These latest increases are all the more noteworthy in view of the fact that a great advance had been made so recently as the beginning of October.

The following table shows the present prices of the principal forms of steel products in marks per ton, as compared with two recent dates, and also with prices at the beginning of the war:

	December 1919	October 1919	August 1919	July 1914
Ingots	1430	755	555	90
Blooms	1465	790	590	95
Billets	1500	825	625	102.50
Slabs	1505	830	630	105
Bars	1745	995	745	14
Wire rods	2000	1200	850	127.50
Heavy plates	2235	1185	860	100
Medium plates	2520	1320	995	...
Thin plates	2585	1385	1010	125
Bands	1925	1100	825	...

Products not included in this list have been raised in due proportion. An addition of 75 marks a ton to the above prices, which are for basic Bessemer steel, must be made for Siemens-Martin qualities. This difference had hitherto been only about 25 marks, but in view of the heavy advance in old material the Economic Ministry consented to increasing the margin as indicated. The Ministry has also given its consent to the new list prices, and they took effect at the beginning of this week. Dealers' prices in the western part of the country have been fixed at 300 to 350 marks more than the prices above listed.

The Pig Iron Association also put on heavy advances for December. Hematite was raised 436 marks to 1,171.50 marks; foundry No. 2, 262 marks to 914.50 marks; No. 3, 262 marks to 913.50 marks, and spiegeleisen, 249 marks to 896 marks. The Siegerland Ore Syndicate has also just advanced crude ores by 5 and roasted ores by 7.50 marks per ton.

Heavy advances have also been made in steel rails of all classes. Heavy rails and ties were marked up to 1,870-1,900 marks, as compared with former prices of 1,080-1,100 marks. Light rails for mines and temporary track were raised from 1,020-1,050 to 1,770-1,800 marks and grooved rails from 1,350-1,380 to 2,220-2,250 marks.

Even Higher Prices May Come

While the advances here detailed are by far the heaviest yet adopted, there is a feeling that high-water mark has not yet been touched; and already the Minister of Economic Affairs has indicated a purpose to stop the upward movement by fixing maximum prices. On the other hand, the government is now understood to be engaged in drawing up a bill to prevent the sale of German products abroad at prices below the world-market prices; and it is believed that this project is dictated in part by the recent low selling of iron and steel products abroad. The plan of the government is to add an export duty equivalent to the difference between the price at which the German manufactures are sold and the average prices abroad. This measure, however, is still in process of incubation; and it may be that it will have only partial application, being restricted to such commodities as are absolutely essential for the public welfare.

No Dumping, but Just the Reverse

At any rate, it may be said that the recently adopted English law against dumping misses the mark widely, so far as it is aimed at German iron and steel. It strikes at products sold abroad at lower prices than prevail in the country of their origin. But it is a well-known fact that German steel producers have been able for months to sell abroad at considerably higher prices than rule in Germany; and, in view of the great depreciation of German currency, foreign buyers have been extremely keen to buy unlimited quantities of steel goods at far higher than the German home prices. That the Germans have not sold much greater quantities has been due solely to their inability to produce. There is, in fact, a tremendous pressure from foreign buyers to place contracts with German works, and if it were possible for them to obtain adequate supplies of coal and ores the whole iron industry would very soon be on a great boom.

But the scarcity of raw materials is apparently an insurmountable difficulty. Coal is so scarce that several of the largest steel producers in the west have recently had to close down, including one of the Krupp mills, also the Hoesch Works. Phoenix was also expected to stop. The price of coal has just been raised again by 7.50 marks.

Swedish Ore Shipments Shut Off

As mentioned in my last report, the re-establishment of the blockade in the Baltic Sea has shut off the shipment of Swedish ores to Germany, and the furnaces

are now badly in want of these ores. The British authorities went through the form of introducing certain alleviations of the blockade in the case of ores about a month ago; but the formalities surrounding the system of getting licenses to import ores have proved so cumbersome—with the sending of applications to England to be passed upon—that no ores have yet come in. The lack of Swedish ores is felt especially in the Silesian district. In the western district the furnaces are running chiefly upon their accumulated stocks and such home supplies as they can get. Even the minettes, the ores of Lorraine, have been reaching the furnaces only in reduced amounts. Now that the Germans have begun to make regular shipments of coal to France, in anticipation of the treaty, the French show less disposition to ship ores to Germany. The mines of the Siegerland, Germany's chief ore district, are particularly hampered just now by the shortage of coal. This has already forced some of them to shut down at a time when furnaces are clamoring for ores.

The Minister of Economic Affairs has adopted a scheme for equalizing the advantages enjoyed by consumers of home ores over the furnaces running on foreign ores. As already pointed out in this correspondence, some of the leading companies have been very hard hit by the depreciation of the German mark, which involves enormous losses in settling for Swedish ores contracted for in Swedish crowns. The Minister has, therefore, announced that a so-called compensation fund will be established for equalizing the cost of ores as among different consumers. The details of the plan have not yet been made public. The iron interests are unanimously opposed to it, however, and demand that prices be left to take their own course in the open market. The producers are also urging the removal of all existing restrictions and government control, but the Minister refused to consent to this.

As intimated above, the market for scrap is very strong, and prices have heavily advanced within a month. In October dealers were selling at 700 to 750 marks the ton, but they are themselves now compelled to pay as high as 900 to 1,000 marks and even more. Of course prices to consumers run considerably higher. It is also believed that the upward movement will continue.

Germany as a Competitor with France

The scarcity of ores and scrap is repeated further up the line of production in half-finished steel. Before the end of the war the mills in the Rhenish-Westphalian region got much of their semi-manufactured material from mills in Lorraine and Luxemburg; but that source of supply has now been either stopped or greatly reduced. In view of general conditions in the German industry, therefore, it is expected that the mills will henceforth work up their own steel into more and more highly finished products. It is felt that the German works will not be able to compete in neutral markets with France in semi-manufactured goods or heavy bars. The French works, largely of German construction, in Lorraine and Luxemburg are too well equipped for cheap production and are too well supplied with cheap ores, to admit of successful competition by the Germans except in the most highly finished products, and it is to be expected that the development in Germany will be toward finer and finer qualities, involving the employment of much skilled labor. The need of the big companies to keep their establishments employed will of itself necessitate such a movement.

The October production of pig iron reached 559,000 tons, as compared with 534,500 tons in September; that of steel ingots, 692,300 tons, against 748,700. These figures were probably not maintained in November.

Large Demand for Steel

The situation in semi-manufactured steel, structural forms and rails is very strong, and it is expected that the demand will increase rather than relax. There is a heavy demand for steel rails and other track-construction materials, and contract periods run far into 1920. Very large contracts are in hands for plates, bars, pipe, wire rods and other forms, and as specifications come in it is found necessary to stipulate longer and longer periods of delivery. From the Silesian district an uncommonly heavy demand for plates and sheets is reported. This applies to heaviest plates and down to the thinnest sheets. Here in Berlin manufacturers find it almost impossible to buy sheets and get them delivered.

The active state of trade previously reported in the cutlery and hardware lines continues with undiminished force. Cutlery manufacturers have met with unexpected success in renewing ante-bellum relations with foreign countries, and large buying from England, Italy and South American countries is mentioned. This trade, however, is also suffering from the coal shortage, and some of the shops have had to shut down from time to time. The Solingen manufacturers have adopted a plan for preventing the selling of cutlery abroad at too low prices. They agree to sell only in the currency of the buying country, and to add from 100 to 300 per cent to the prices that prevailed there before the war. The addition will in most cases go above 200 per cent. As announced, this plan applies to west European countries, Italy and Scandinavia; no mention is made of the United States or other countries outside of Europe.

Steel Works Union to Disband

It now appears certain that the Steel Works Association will cease to exist at the end of this month. This view was general at a meeting of the organization at the beginning of last week; and it is expected that the works will very soon begin taking contracts for their own account. The Government is opposed to the dissolution of the association, probably having in view the use of it as basis for "socializing" the iron trade later on, just as it is now using the coal syndicate. But the leaders of the trade have been convinced for some time that the association would not be able to continue its existence after the loss of the Lorraine, Luxemburg and Saar works. Two concerns announced as early as midsummer that they would withdraw; and at that time the dissolution of the organization became so imminent that the government in a high-handed way took the matter in hand and declared the renewal till March 1, 1920. That action, however, did not remove the opposition of several of the big concerns; and at the meeting mentioned it was generally agreed that the time for dissolution had arrived. Formal action in that sense, however, appears not to have been taken.

Still Rumors of Americans Buying Works

Reports continue to be circulated claiming that American capitalists are trying to buy up Silesian works. Shares of companies in that district are reported as having been heavily bought here recently for American account. It is impossible to determine here how much truth there is in such reports, but they look at least doubtful. There is also a dubious report going the rounds of the press to the effect that there is an American plan to supply Germany with steel with which to repair old locomotives, and so get the coal output of the mines regularly distributed. It was even asserted that representatives of the American steel industry were expected to arrive about this time at Coblenz for the purpose indicated.

The Mannesmann Roehrenwerke of Duesseldorf, which almost monopolizes the pipe trade in Germany, has declared a dividend of 5 per cent, comparing with 15 per cent last year. The Krupp Company is again expected to pass its dividend, as last year. The company is still feeling around for new lines of production.

A Troubled Year in the Steel Trade

(*Continued from page 3*)

of 1919 on a complaint filed against the United States Steel Corporation and other steel manufacturers by the Western Association of Rolled Steel Consumers. There had been for more than a year agitation on this subject by manufacturing consumers of steel in the Chicago district. Their activities were rather increased by the effort made by jobbing and other interests at Duluth, Minn., to get a Duluth basing price. The complaint filed with the Federal Trade Commission charged that the Steel Corporation and other producers of steel in the Chicago district have been adding $5.40 per net ton, which is the freight from Pittsburgh to Chicago, to what the petitioner considered to be fair prices for finished steel. The most serious charge was that the practice of basing delivered prices of steel in various districts on the price at Pittsburgh mill was due to an agreement among the steel producers in order to maintain prices.

On Dec. 2 many steel manufacturers appeared before the Federal Trade Commission for a hearing on the questions involved in the controversy, and a greater array of legal talent spent the next five days in arguing the case. No testimony was heard, the only question involved, as the commission explained, being whether it should undertake to go into the matter. The commission's experts will go to work on the various exhibits and it may be a matter of months before the commission will be ready to rule on the question of jurisdiction. The commission may then order a formal complaint drawn up and then will begin the taking of testimony before the commission's examiners. If, after all these proceedings, the Pittsburgh basing should be declared illegal and the commission should order its discontinuance, the steel companies would still have an appeal to the United States courts.

The Un-American Steel Strike

The most important development of the year in the labor situation was the failure of the thoroughly un-American element among the labor union leaders to obtain control of the steel plants of the country. The movement had been authorized by the American Federation of Labor and promised to be formidable when investigation developed that the leading spirit was one William Z. Foster, an avowed syndicalist who in a book called "The Syndicalist" had promulgated the most extreme doctrines of the revolutionary elements of the labor unions. The first nation-wide expose of Foster and his radical associates was made in THE IRON AGE of Sept. 18 and was quickly followed by publication in many newspapers, by speeches in Congress and by testimony before investigating committees. It was disclosed that the radical leaders had largely increased the membership of the union among foreign-born workingmen and based their hopes of success largely on the ignorance and viciousness of that element. This fact alienated American workingmen by the thousands and assured the failure of the strike. The demands which the union organizers announced would be made were twelve, including the 8-hr. day, collective bargaining, abolition of 24-hr. shifts, increases in wages, double pay for overtime, collection of union dues by the companies, abolition of company unions and abolition of physical examination.

Several weeks before Sept. 22, the date fixed for the strike, Judge Gary had refused to see a committee consisting of Foster and other union leaders. As he said later, when testifying before the Senate Committee on Education and Labor, he believed that labor ought to be encouraged to deal collectively, "but," he added, "dealing collectively in the form of committees or however they may themselves decide is one thing and dealing collectively as insisted on by the labor unions, which means that the labor leaders shall decide all these questions and shall represent the men whether they are asked to or not and will establish a basis for the closed shop, is a different thing."

Operations Seriously Affected

Although doomed to failure from the beginning, the steel strike came on Sept. 22 and resulted in almost complete paralysis of the iron, steel and allied manufacturing lines in the Youngstown, Buffalo, Wheeling, Cleveland and Chicago districts, while in Pittsburgh the success of the strike was much less pronounced. In the Youngstown district, 44,000 men either quit work or were thrown out of employment. Little steel was made at Youngstown until about Oct. 15, when all plants were operating in part. It wrs not until a month later that operations approached normal. A Youngstown banker estimates the loss of wages to employees due to the strike at $8,500,000 in the Mahoning Valley and the Youngstown Sheet & Tube Co. states that the strike cost its employees $2,707,000 in wages. Failure of the unions to pay strike benefits was one of the factors in ending the strike; another was the united front presented by the manufacturers.

In the Chicago district the strikers were better organized than the mill officials believed, and through intimidation kept many loyal employees from returning to work. As a result of assaults on workingmen by strikers, the Indiana State militia was called out to patrol Gary and Indiana Harbor and was subsequently reinforced by 4000 regular Army men under Major General Wood, who took charge of the situation at Gary, permitting the militia to give its attention to Indiana Harbor and East Chicago. This was the real turning point of the strike in that district, as thereafter the employees who desired to work were assured protection. Steel plants in the Chicago district had practically recovered normal enrollment when the coal strike was called Nov. 1. A shortage of fuel again made the curtailment of operations necessary in some plants. But this was to a large extent confined to about two weeks. The Gary plant of the Illinois Steel Co. has now 10,000 employees on its payroll—a normal enrollment. The South Chicago plant has about 95 per cent of its usual force of 9,500 men and the Inland Steel Co. has a 100 per cent enrollment of its 8000 employees.

The contention that the steel strike was more generally supported by the alien workers than by the American is borne out by the facts. For example, on Oct. 11 the enrollment of a representative steel plant showed that 55 per cent of the Americans had returned for work as against only 18 per cent of the Austrians and a still smaller percentage of other nationalities. On Oct. 22, 85 per cent of the Americans were at work as against 34 per cent of the Austrians and smaller percentages of other aliens.

In the Cleveland district, many of the employees were opposed to the strike but quit work because of intimidation and violence. The shut-down was complete at the American Steel & Wire Co., Upson Nut Co., Otis Steel Co., Cleveland Steel Co. and Lake Erie Bolt & Nut Co. At one time about 21,000 men were idle. At present most of the Cleveland mills have an abundant supply of labor, but a few outside of the American Steel & Wire Co. report a shortage. The usual number of men are now employed at nearly all plants, but production is not yet up to normal.

In the Pittsburgh district, production was greatly curtailed for a time and the strike was severely felt the last week in September and in nearly all of October, but late in October the strikers returned in large num-

bers. Pittsburgh was less affected by the strike than other important centers. Several attempts to get the men employed by the Jones & Laughlin Steel Co. to strike failed as did similar efforts at other plants.

It is difficult to estimate the loss of production due to the strike. One reason is that the coal and steel strikes overlapped each other several weeks. No statistics of steel ingot production were collected for the last four months of the year, but judging from the falling off in pig iron output the loss in steel ingot production, due to the two strikes, may be put at about 2,500,000 tons.

On the whole, there was much less violence than in strikes in the iron industry in other years. That this was true in spite of the radical leadership was attributed largely to the inability of strikers and others to obtain liquor owing to the enforcement of prohibition.

While the steel strike was the event in which the industry was most directly interested, it was closely connected with other events in the industrial world, particularly with the effort of the President to establish better conditions through the ill-fated industrial commission. It was also connected with the investigation at Washington by the Senate Committee on Education and Labor as to the causes and results of the steel strike. This investigation thoroughly supported those who had pointed out the un-American leadership of the strike. The chief recommendation of the committee at the conclusion of its investigation was that a labor commission similar to the War Labor Board be appointed. This has not yet been done, and probably will not be until after the second industrial conference makes its report.

The first industrial conference failed, not because the employers were opposed to collective bargaining but because the labor group, headed by Mr. Gompers, who had placed his stamp of approval upon William Z. Foster, insisted upon the labor unions' own kind of collective bargaining, which meant bargaining through the American Federation of Labor as declared in the Atlantic City convention of that organization. The second industrial conference is certainly unlike the first in one respect, that is, it conducted its sessions in secret and nothing was reported from the meetings until Dec. 28, when it gave the press a preliminary report proposing the establishment of a national industrial tribunal, consisting of nine members appointed by the President.

Earnings

Data are not available for a proper comparison of earnings of steel companies in 1919 with those in 1918, but in general profits fell far short of those resulting from war work in the preceding year. The United States Steel Corporation in the first three quarters of 1918 had net earnings of $169,171,261, after heavy deductions for excess profits taxes, amounting in the third quarter alone to $101,987,387. The net earnings in the first three quarters of 1919, after deductions for taxes, which were much less than in 1918, were $114,577,382.

The Lackawanna Steel Co. showed a deficit for the second quarter of the year. Its net profit, after all deductions, for the first three quarters of the year was $1,317,350, which compares with $9,839,102 in the first nine months of 1918.

The Republic Iron & Steel Co. reported a deficit of $334,448 in the second quarter after paying dividends. Its net profit for the three quarters of the year, applicable to dividends, was $2,836,019. In the full year of 1918 it had net earnings, after deductions for war taxes and contingencies, of $13,226,055, and the amount applicable for dividends in 1918 was $7,791,933.

While the Steel Corporation's dividends on its common stock were 18 per cent in 1917 and 14 per cent in 1918 they were at the rate of 5 per cent throughout 1919. All the steel companies suffered very considerable loss by the steel strike and by the cutting down of fuel supply in the last quarter of the year, and their statements for that period will therefore be the poorest of the year.

The Pittsburgh Iron Trade the Year After the War

BY ROBERT A. WALKER

IN the first week in January, prices of pig iron in effect were those recommended by the Price Committee of the American Iron and Steel Institute. They were $30 for basic, $32.20 for Bessemer, $30 for gray forge and $31 for No. 2 foundry, at Valley furnace, the freight rate for delivery in the Pittsburgh district being $1.40 per ton. Considerable iron was due consumers at prices in effect prior to Jan. 1, which were $3 per ton higher than those noted above. There was much uncertainty as to the future of the steel market, and consumers were not taking iron very rapidly. In many cases, iron sold to consumers prior to the reduction of prices, was being offered for resale by the buyers at lower than regular prices, but there was very little demand. In the latter part of January, the amount of iron offered for resale largely increased, and there was considerable pressure on the part of furnaces to sell. At this time, a large number of blast furnaces in the Pittsburgh, Mahoning and Shenango Valleys were idle for repairs, owners taking advantage of the quiet market to put their furnaces in first-class shape, after a long period of great activity. January closed with the iron market very dull, prices being weak and demand limited. Shipments were being held up by consumers, and the number of blast furnaces that had gone out for repairs had increased.

On Feb. 18 a meeting of the Associated Manufacturers of Merchant Pig Iron was held in Pittsburgh, and the consensus of opinion among the furnace operators seemed to be that lower prices on pig iron were likely to come, and that furnaces with high costs would not be able to meet the market and would have to go out of blast. February closed with conditions in pig iron showing no betterment, either in demand or prices. These conditions continued in March, but on March 20 a conference was held at Washington between the Industrial Board of the Department of Commerce and a special committee representing the iron and steel industry, at which reductions in prices were made in iron and steel products, ranging from $4.25 per ton on basic iron up to $7 per ton, or more, on finished steel products. This put the price of basic iron at $25.75, Bessemer $27.95, gray forge $25.75, and No. 2 foundry $26.75, all at Valley furnace. On March 26 another meeting of the Associated Manufacturers of Merchant Pig Iron was held in Pittsburgh, at which the reductions in prices on pig iron made in Washington were fully discussed. All contracts for pig iron made prior to the March 21 schedule were revised to meet this schedule.

The local pig iron market early in April was very quiet, and the prices of March 21 were being shaded, largely on resale iron, which was freely offered. In May and June the low ebb was reached, many furnaces having gone out because they had no orders, and others for repairs. In fact, output of pig iron was so small that it was figured late in May that the melt of pig iron had finally come up to output, and prices were showing some signs of strength. In the latter part of June there was a little activity in steel making pig iron, and considerable inquiry had come up for malleable and foundry iron. On the whole, business in pig iron in the first half of 1919 was regarded by the producers as very unsatisfactory.

July opened with steel making pig iron quiet, but

with a fairly active demand for foundry and malleable. Early in July a sale of 10,000 tons of malleable was made at the full price of $27.25 at Valley furnace to a large consumer, and other consumers were also buying freely. At this time a sale of 6000 tons of basic was made at $25 at Valley furnace, a cut of 75c. under the regular price. Inquiry for pig iron was getting better, and some furnaces that had been idle for several months were going in blast again. Late in July the Weirton Steel Co. started its new blast furnace at Weirton, W. Va., on foundry iron, but later turned on basic, its output, about 500 tons per day, being sold in the open market. The real upward movement in demand for pig iron and in prices started in the last half of July, when 75,000 tons of basic iron and probably 25,000 tons of Bessemer were sold at very close to regular prices. In the first week in August a leading consumer bought 6000 tons of Bessemer and 3000 tons of forge, paying the full price of $27.95 for the Bessemer and $25.75 for the basic, at Valley furnace. The demand for foundry iron was heavy, and prices were holding firmly.

Early in September the real upward swing in demand and prices for pig iron started, and the market became active. In the first week of September the Carnegie Steel Co. was operating 50 of its 59 blast furnaces, and the other steel companies were operating all their furnaces that were in condition. Only two stacks in the Mahoning Valley were idle, these being Hannah of Republic Iron & Steel Co. and Niles of Carnegie Steel Co., an isolated stack. Prices on pig iron were showing strong signs of advancing, the market being very firm. At this time the entire steel industry was thrown into a steel strike which started on Sept. 22. Many blast furnaces, steel plants and finishing mills were shut down and the situation was very discouraging. Early in October the steel strike was at its worst, and little or no attempt was being made to do business in pig iron or anything else. There was much disorder and production was at a low point. By Oct. 15 the situation commenced to get better and late in that month operations of blast furnaces and steel works had improved very considerably in the Pittsburgh and Youngstown districts, but at Wheeling there was no attempt made to start idle blast furnaces or steel works. Early in November the coal strike started, but fortunately pig iron producers had laid in large supplies of coal, and there was little interruption in operations of the blast furnaces in the Pittsburgh and nearby districts. In November and December there were heavy advances in prices of pig iron.

The only new additions to blast furnace capacity made in the Pittsburgh district during 1919 were the new No. 5 blast furnace of the Jones & Laughlin Steel Co. at Aliquippa, Pa., a 500-ton stack started in the summer, and also the new blast furnace of the Weirton Steel Co. at Weirton, W. Va., a 550 to 600 ton stack started late in July.

The following table gives the monthly prices in 1919, averaged from weekly reports in THE IRON AGE on Bessemer, basic, gray forge and No. 2 foundry iron at Valley furnace, the rate for delivery in the Pittsburgh district being $1.40 per gross ton:

Average Monthly Pig-Iron Prices, f.o.b. Valley Furnace—Per Gross Ton

1919	Bessemer	Basic	No. 2 Foundry	Gray Forge
January	$32.20	$30.00	$31.00	$30.00
February	32.20	30.00	31.00	30.00
March	31.74	28.94	29.94	28.94
April	27.95	25.75	26.75	25.75
May	27.95	25.75	26.75	25.75
June	27.95	25.75	26.75	25.75
July	27.95	25.75	26.75	25.75
August	27.95	25.75	26.75	25.75
September	27.95	25.75	26.75	25.75
October	27.95	25.75	26.75	25.75
November	29.86	28.31	31.50	29.31
December	35.25	34.25	36.75	34.50

Semi-Finished Steel

When the year 1919 opened the demand for billets, sheet bars and forging billets was only fair, some of the sheet and tin plate mills not running to full capacity and they were not taking out as much steel as usual. At the same time a large tonnage of shell steel in the forms of billets and sheet bars was being offered in this market, and at as low as $34 per ton, much under the price of soft steel billets, which in early January was $43.50 at mill. At the close of January there was very little demand for billets or sheet bars, as it looked at that time as though prices, not only on semi-finished steel, but on semi-finished steel products as well, would be lower. Shipments were being held up, and offers of both billets and sheet bars at lower than the regular prices, failed to bring out any new business.

When July opened the demand for billets and sheet bars was better than at any time in the first half of the year. By the middle of that month steel mills had got up to about a 75 per cent operation, and the sheet and tin plate mills were taking out more steel. At the close of July the demand for billets and sheet bars had grown so that the Carnegie Steel Co. started up its Columbus, Ohio, works, and was also rolling some sheet bars at the Edgar Thomson works. By early August, a scarcity in supply of sheet bars had come, and the American Sheet & Tin Plate Co. was bringing sheet bars from the Chicago and Gary districts to its Pittsburgh mills, its regular source of supply, the Carnegie Steel Co. not being able to give it steel fast enough. In late August and early September, premiums of $1 to $2 per ton were being offered for prompt sheet bars, and they were hard to find. This condition lasted until the steel strike was declared on Sept. 22, and many sheet and tin plate mills closed, also some of the larger steel mills. For more than a month, steel output was below 25 per cent of capacity, but the men gradually returned to work, starting in November, and at the close of that month the steel strike was over, as far as operation of the mills in this district was concerned. In December there were sales of soft open hearth and Bessemer billets and sheet bars at $5 per ton or more above the March 21 prices.

Finished Iron and Steel

Following the signing of the armistice on Nov. 11, 1918, there was at once a great falling off in the de-

Wire Rod Prices at Pittsburgh for Eighteen Years

Quotations on wire rods did not regularly appear in market reports until late in 1901. The table given below therefore represents the available figures nearly as far back as public prices are concerned. They are for Bessemer wire rods, per gross ton, at Pittsburgh, averaged from weekly quotations in THE IRON AGE. The quotations for November and December, 1917, and all of 1918, are Government prices and apply also to open-hearth rods.

	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919
January	$33.45	$24.70	$30.00	$31.00	$33.75	$37.00	$24.30	$33.00	$33.00	$28.00	$34.37	$30.00	$25.50	$25.00	$43.00	$75.00	$57.00	$57.00
February	35.00	25.75	30.00	31.00	34.00	37.00	25.00	33.00	33.00	28.75	25.00	30.00	26.38	25.00	48.00	77.50	57.00	57.00
March	35.50	36.62	30.80	31.70	34.00	37.00	25.00	33.00	33.00	29.00	25.00	30.00	26.50	25.00	54.50	81.00	57.00	55.75
April	36.00	37.00	31.00	34.00	34.12	37.00	25.00	29.00	32.50	29.00	25.00	30.00	26.00	25.00	60.00	85.00	57.00	53.50
May	36.80	37.00	30.50	34.00	34.40	37.00	25.00	27.50	32.00	29.00	25.00	30.00	25.50	25.00	60.00	86.00	57.00	52.00
June	37.00	36.62	29.20	33.30	34.00	37.12	23.50	27.50	30.80	28.25	25.00	29.50	24.50	25.00	53.75	92.50	57.00	52.00
July	36.00	35.80	28.00	31.87	34.00	36.50	23.00	29.40	29.25	27.00	25.00	28.30	24.50	25.00	52.73	96.25	57.00	52.00
August	36.09	35.00	28.00	32.10	34.00	36.10	23.25	31.00	28.25	27.00	25.80	28.00	25.00	27.00	55.00	94.00	57.00	52.00
September	35.87	34.75	27.00	31.12	34.00	36.00	23.00	31.50	28.00	27.00	27.37	28.20	25.40	29.40	55.00	88.75	57.00	52.00
October	35.00	34.00	26.00	31.75	34.50	35.40	23.00	31.87	28.50	28.01	28.50	28.00	25.88	31.75	55.00	77.25	57.00	52.00
November	35.50	31.62	26.75	32.10	35.50	34.00	23.00	32.50	29.12	25.20	29.75	25.87	25.25	30.25	63.00	57.00	57.00	54.50
December	34.50	30.50	29.80	32.50	37.00	34.00	23.00	33.00	28.00	24.50	30.00	25.17	25.00	29.50	68.75	57.00	57.00	59.50

mand for finished iron and steel products, and this lasted well into the first half of 1919. Consumers and jobbers were all looking for lower prices, the reduction of $3 to $4 a ton on finished steel, effective on Jan. 1, not having had the effect of increasing the demand. The trade believed this was only the first of reductions to come in prices, and was holding off from buying. This condition lasted into March, and on March 21 a further reduction in prices of $5 to $7 per ton was made, but even this large cut did not stimulate demand. Finishing mills were operating only at 60 to 70 per cent of capacity, and the situation was far from satisfactory. Late in July the new demand for finished iron and steel started to get better, and was heavy in August and September. On Sept. 22 the steel strike started and many finishing mills in the Pittsburgh, Wheeling and Youngstown districts were closed from a month to six weeks, while the strike was being fought out. By Nov. 1 the steel strike was pretty well over, but then came the coal strike, and idleness again threatened the mills. However, they had all laid in large stocks of coal, and mills in the Pittsburgh and nearby districts were just about to the end of their coal supply, when the coal strike was settled, and the miners went back to work. In the last month or six weeks of 1919 there was a very great shortage in the supply of nearly all kinds of finished iron and steel, and premiums over regular prices, ranging from $2 to $20 per ton, the latter for sheets for prompt shipment, were being offered by jobbers and consumers who were short of steel. The year closed with the finishing steel mills well sold up over the first quarter of this year, and in the case of sheets and tin plate, and also tubular goods, some of the larger mills have little to offer over the first half.

Line Pipe and Oil Well Tubular Supplies

The demand for iron and steel pipe, and for other tubular goods, was heavy all through 1919, especially for line pipe and oil well tubular goods, and the mills closed the year with their books filled for the first half of this year, and in the case of the leading interest, practically over the entire year. Development of oil territory last year was abnormally heavy, and it promises to last for two or three years to come. In the last six months of the year there was a famine in the supply of line pipe and oil well tubular goods, and the mills turned down in that period far more business than they booked. In spite of the heavy demand, the National Tube Co. and all of the independent mills steadily held to the March 21 discounts, with the single exception of the Wheeling Steel & Iron Co., which advanced prices on steel pipe on July 10, $5 per ton on butt-weld, and $10 per ton on lap-weld. Later, the A. M. Byers Co. advanced its prices on iron pipe, but all others maintained the March 21 prices up to the close of the year.

Old Material

The first half of 1919 was very unsatisfactory in the scrap trade, from the standpoint of business and profits. When the armistice was signed on Nov. 11, 1918, there was a very great drop in prices of scrap, and consumers stopped buying. In the latter part of January, heavy melting steel scrap had gone to $16, and other grades were selling at proportionately low prices. Almost an entire absence of buying, and also low prices on scrap ruled all through the first half of the year. Late in June and in early July, an improvement in demand came for scrap, and prices were also better. In October prices of heavy melting steel scrap had gone to $19, and the demand was active. Prices on scrap did not decline during the steel strike, but on the contrary they advanced, and late in December heavy steel melting scrap was selling at $25, and the demand for nearly all grades was active.

Old Material Prices, Pittsburgh—1919—Per Gross Ton

Month	Heavy Steel Scrap	No. 1 Cast	Bundled Sheet Scrap	Cast Iron Borings	Machine Shop Turnings
January	$23.75	$24.20	$15.80	$15.00	$11.20
February	14.75	18.75	12.12	10.37	8.50
March	14.00	18.00	11.00	9.75	9.00
April	15.38	19.00	11.50	10.62	10.12
May	14.80	17.20	11.10	10.60	11.62
June	17.12	18.50	12.87	11.19	9.68
July	19.70	20.40	13.90	13.20	11.60
August	21.00	23.50	15.75	15.25	13.50
September	19.25	23.50	15.50	15.38	12.25
October	19.00	23.80	15.80	17.90	12.75
November	22.25	27.25	18.25	17.50	14.00
December	24.38	28.75	18.75	17.75	14.25

The Chicago Iron and Steel Trade in 1919

BY GILBERT L. LACHER

THE year just closed spans the gap between business stagnation and a seller's market. Following the signing of the armistice, the starting of the readjustment of industry to a peace-time basis together with a general feeling that a marked deflation in prices would occur, caused consumers to postpone their purchases entirely or to buy very sparingly for pressing needs. The general reduction in prices effective at the first of the year was followed by a readjustment of old contracts to the new levels, but these measures taken voluntarily by the producers to inculcate confidence in the market, did not stimulate buying. On the contrary, consumers continued exceedingly cautious and when they did buy, demanded guarantees against declines. Their timidity was encouraged by disquieting reports of growing unemployment emanating from the large industrial centers, which added strength to the belief that the country was entering a period of depression.

In retrospection it would appear that this sentiment was due to psychological causes rather than the actual economic potentialities of the time. At any rate, interest in the market seemed on the verge of a revival when the Government's plan of price stabilization caused consumers to resume a waiting attitude. When the so-called Redfield prices were finally announced on March 21, it was felt that the final obstacle in the way of business activity had been overcome. A new element of uncertainty developed, however, when the Railroad Administration refused to buy at the new prices, despite the fact that the principal reason for their creation was to make way for large Government purchases. The controversy between the Director-General of Railroads and the head of the Industrial Board, the sponsor of the stabilization plan, continued for several weeks, finally resulting in the resignation of the latter and the inauguration of an unrestricted market. Despite the failure of the regulatory efforts of the Government, the Redfield prices were generally adhered to by producers for several months and in the case of some commodities until the close of the year. The Railroad Administration, notwithstanding its strenuous objections to the plan of March 21, found no mills willing to make concessions and finally, towards the end of May, purchased 200,000 tons of rails, under protest, at the Industrial Board prices.

The collapse of the stabilization plan brought with it a gradual resumption in business activity. Wire products led the van both on account of an accumulation of deferred orders for spring requirements and a growing expansion in building activity. Bolts and nuts also commenced to show signs of life as the result of purchases by the automotive industry. Buyers continued to exercise caution for a time, however preferring to order small quantities repeatedly rather than to pile stocks. Despite the slow recovery of confidence in the market, the prices of most products remained firm, the exceptions being sheets, cast-iron pipe and Southern pig iron. For a period of two months' terminating about the middle of June, sheet mills generally conceded from $2 to $4 a ton under the Redfield prices. Cast-iron pipe, which was reduced $5 a ton on March 21, declined a like amount in the latter part of May, but had gained sufficient strength two months later to warrant a $2 advance. From the middle of May until about the close of June, Southern producers of foundry iron absorbed the freight from Bir-

mingham, putting their prices on a parity with those of the local furnaces.

June Turning Point in Market Sentiment

The middle of June marked the turning point in the Chicago market. At that time the improvement in general business over that done in May was placed as high as 50 per cent by prominent local sellers. Industries were reviving throughout this territory and the only apparent barrier to a high rate of activity in all lines of iron and steel production was the failure of the railroads and agricultural implement manufacturers to purchase for their requirements. Buyers in increasing number asked for contracts to protect themselves against advances, whereas a few months before they wanted guarantees against declines. Malleable and gray iron foundries commenced to buy generously for their last half requirements. Jobbers and fabricators entered the market to replenish their stocks. An expansion in building activity and the marked development of the automotive industry and the Southwestern oil fields accounted for the booking of encouraging tonnages by the mills. The Pacific Coast shipyards also commenced to buy moderately. A particularly promising portent was the rapidity with which inquiries were followed by purchases. Old material, which is a very sensitive barometer of business conditions, was stimulated through the speculative buying of dealers who anticipated a marked increase in the consumption of scrap. Of finished products, the first to advance were bolts and rivets which were marked up 5 and 10 per cent respectively on July 1. Almost simultaneously independent manufacturers of wire products advanced their prices, although the leading interest continued to hold to the March quotations. From that time until the end of the year, the tendency of prices was exclusively upward.

In the first month of the second half of the year, the demand continued to expand. The agricultural implement industry, which had held aloof from the market longer than other interests, joined the ranks of buyers, leaving the railroads practically alone as a dormant consumer.

Cycle of Strikes Concurrent with Business Expansion

Concomitant with the steadily accumulating momentum of business was a marked increase in labor trouble. The foundries were the first to be affected by strikes, some of which occurred as early as April and May, while a more general tie-up developed in July. The increasing demand for structural material received a set-back when all building activity in the city of Chicago was suspended on account of a lockout of the building trades unions which lasted from July 18, until the middle of September. In the first week in August, when the mills were approaching a comfortable operating basis, the strike of railroad shopmen forced the leading western producer to curtail production materially. On August 12, only four furnaces each were in blast at the Gary and South Chicago plants of the Corporation. Following the return of shopmen to work on August 14, mill operation again showed improvement. Early in September the mills of the leading interest were running at the rate of 90 per

Pig Iron, Finished Material and Scrap, Chicago

The table below shows monthly prices of malleable pig iron at Chicago from 1902 to 1919, inclusive, averaged from weekly quotations in THE IRON AGE, in dollars per ton of 2240 lb.

Malleable Pig-Iron Prices, Chicago

	1902	1903	1904	1905	1906	1907	1908*	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919
Jan.	$17.20	$23.24	$14.50	$17.50	$19.37	$26.00	$18.60	$17.09	$19.00	$15.50	$14.25	$17.90	$13.88	$13.00	$19.00	$30.94	$33.50	$31.50
Feb.	17.75	23.00	14.50	17.50	19.19	26.00	18.25	16.75	19.00	15.50	14.14	17.31	13.94	13.00	19.00	31.75	33.50	31.50
March	18.50	22.87*	14.00	17.50	19.00	26.25	17.50	16.50	18.40	15.50	14.00	17.25	14.25	13.00	19.40	35.40	33.50	30.44
April	19.50	21.82	14.00	17.50	18.77	26.50	17.50	16.50	17.50	15.25	14.00	17.05	14.25	13.00	19.50	39.00	33.50	27.25
May	21.80	20.77	14.00	17.37	18.35	26.60	17.56	16.66	17.06	15.00	14.40	16.00	14.06	13.00	19.50	43.60	33.50	27.25
June	22.00	19.50	13.85	16.65	18.00	26.25	17.37	16.50	16.75	15.00	14.50	15.62	13.88	13.00	19.50	50.25	33.50	27.25
July	22.75	18.66	13.75	16.37	18.37	25.62	17.50	16.90	16.56	15.00	14.50	14.65	14.00	13.00	19.50	55.00	33.50	27.25
Aug.	23.00	17.59	13.75	16.50	18.95	24.80	17.50	17.12	16.50	14.80	15.10	15.00	14.00	13.44	19.00	55.00	33.50	27.25
Sept.	24.00	16.94	13.50	16.56	20.12	24.40	17.26	18.50	16.40	14.50	16.25	15.00	13.25	14.30	19.00	54.75	33.50	27.25
Oct.	23.90	16.25	13.75	17.37	21.32	22.40	17.00	18.50	16.06	14.50	17.10	15.20	13.00	15.25	19.88	33.50	34.50	28.25
Nov.	23.87	15.00	15.87	19.00	24.16	20.25	17.00	19.00	16.00	14.35	17.87	14.87	12.88	17.13	25.80	33.50	34.50	31.50
Dec.	24.00	14.50	16.50	19.50	26.00	18.75	17.00	19.00	16.00	14.35	18.00	14.63	12.90	18.20	29.50	33.50	34.50	39.50

*From this time on the prices are given as at furnace near Chicago, and 35c. to 50c. per ton should be added to get the price delivered to Chicago foundries.

The table shows the course of prices of pig iron, finished iron and steel and old material in Chicago market in 1919, compiled from the weekly reports in THE IRON AGE:

Pig Iron, Finished Iron and Steel and Scrap, Chicago

	Northern Coke No. 2	Lake Superior Charcoal	Southern Coke No. 2	Common Bar Iron, Cents	Soft Structural Steel Bars, Cents	Steel, Cents	Cast Borings, Net Ton	No. 1 Railroad Wrought, Net Ton	Heavy Cast Scrap, Net Ton	Heavy Melting Steel Scrap, Gross Ton	Old Steel Rails Rerolling Gross Ton
January	$31.00	$38.85	$36.00	3.13	2.97	3.07	$11.20	$19.10	$22.95	$17.40	$22.10
February	31.00	38.85	36.00	2.95	2.97	3.07	7.81	15.13	20.00	15.06	16.44
March	29.94	38.85	34.94	2.84	2.88	2.98	9.06	15.38	21.63	15.63	16.28
April	26.75	38.85	31.75	2.50	2.62	2.72	9.35	16.05	21.45	16.41	17.55
May	26.75	38.85	29.25	2.50	2.62	2.72	8.31	15.60	20.12	15.62	18.75
June	26.75	38.85	28.00	2.50	2.62	2.72	9.31	16.87	20.75	16.69	19.75
July	26.75	31.75	31.75	2.52	2.62	2.72	11.35	18.60	23.30	19.40	25.15
August	26.75	32.25	32.19	2.62	2.62	2.72	12.75	20.75	24.50	20.83	29.50
September	26.75	32.75	32.62	2.62	2.62	2.72	12.10	19.50	24.20	19.10	26.80
October	27.75	33.44	32.90	2.66	2.62	2.72	10.35	19.38	25.00	18.25	27.19
November	31.00	38.50	36.00	2.73	2.62	2.72	11.50	22.88	28.13	20.88	31.25
December	39.00	43.00	39.80	2.83	3.12	2.72	12.65	24.10	32.35	21.80	31.90
Averages											
1918	33.25	37.88	37.75	3.50	3.08	3.18	15.94	29.77	27.71	28.81	33.71
1917	41.13	44.14	40.38	3.77	3.772	4.275	13.64	30.40	20.05	27.86	34.74
1916	20.25	21.33	19.85	2.31	2.94	2.83	6.99	17.16	13.10	16.69	18.59
1915	14.02	16.10	14.73	1.24	1.48	1.48	5.57	10.27	9.96	10.91	11.73
1914	13.60	15.60	14.46	1.06	1.32	1.34	4.61	8.66	9.76	9.37	10.96
1913	15.95	16.50	16.12	1.43	1.55	1.60	5.36	10.80	10.44	10.90	13.33
1912	15.32	16.77	16.11	1.32	1.42	1.46	6.67	12.54	12.29	12.13	14.19
1911	14.87	16.96	14.80	1.22	1.47	1.50	5.34	11.22	11.08	10.92	12.91
1910	17.10	18.67	16.30	1.45	1.62	1.66	5.50	12.90	13.32	13.43	16.34
1909	17.49	19.50	17.30	1.43	1.50	1.59	6.37	13.76	13.79	14.45	15.82
1908	17.57	20.24	16.76	1.56	1.65	1.82	5.37	12.45	12.69	12.45	14.40
1907	24.50	26.56	24.47	1.78	1.77	1.87	9.73	14.63	17.26	15.03	17.53
1906	20.43	20.72	19.44	1.71	1.68	1.86	8.69	15.62	14.55	14.74	17.15
1905	17.65	17.99	16.66	1.65	1.65	1.78	8.57	16.14	13.50	12.97	15.02
1904	14.37	15.50	15.92	1.43	1.50	1.71	4.72	12.45	10.95	10.72	12.54
1903	19.25	22.13	18.31	1.65	1.72	1.75	7.23	16.03	14.75	15.50	19.04
1902	20.86	23.50	20.10	1.71	1.73	1.75	8.89	19.68	15.03	17.37	23.35
1901	15.38	17.50	14.60	1.58	1.58	1.70	4.20	13.00	11.25	12.84	16.06
1900	19.47	22.00	18.35	1.75	1.75	2.00	6.65	15.00	11.00	12.84	15.50

cent of ingot capacity, while the foremost independent, which had not been affected by the railroad strike, was on a 75 per cent basis.

The strike of the railroad shopmen had hardly passed into history when the steel workers struck. The initial effect of the walkout in this district was to cause almost a complete paralysis of the industry. Only the bar iron and rail carbon steel mills, which operated under an agreement with the Amalgamated Association of Iron and Steel Workers, and a few merchant blast furnaces at outlying points, suffered no interruption in operation. Although the producers in this territory were seriously affected at first because the intimidatory tactics of the strikers prevented the loyal workers from reporting for work, their final recovery from the strike was perhaps more complete than that of mills in some other sections of the country. The plants in the Chicago district had regained practically their normal working forces when the coal strike was called at the beginning of November. This industrial dispute affected the bar iron and rail carbon steel plants more quickly than it did the large steel mills which had bigger fuel reserves. By the end of the month, however, the leading interest was forced to curtail operation and is only now getting back to normal.

Price Advances Follow Strikes

The labor difficulties of the past half year have had a stimulating effect on prices. Northern foundry pig iron has advanced from $26.75 per ton, the March 21 basis, to $40. Southern producers of foundry advanced their prices to $35, Birmingham, for 1.75 to 2.25 per cent silicon, and then withdrew from the market. The advances in pig iron are not surprising in view of the material reduction in output during the steel strike. The leading Northern producer in this territory, for example, is estimated to have been set back from 175,000 to 200,000 tons in its production program. Bar iron, which was exceptionally dull throughout the summer and early fall because of the absence of railroad buying, came into its own during the steel strike, when it was purchased as a substitute for mild steel. It advanced a number of times and is now quoted at 2.87c. Chicago, or nearly a half a cent above the price which prevailed earlier in the year. Rail carbon steel bars also advanced, and bolts and nuts and cast-iron pipe took further jumps.

Soft steel bars, shapes and plates have been exceptionally steady throughout the year, largely because of the efforts of the big mills to keep prices down. The close of the year, however, sees the larger local interests practically out of the market on these products, leaving the field open to other plants which are experiencing no difficulty in exacting premiums above the Redfield prices. This is particularly true of soft steel bars, as the leading interest has been taking business in shapes and plates at the old prices until very recently and, even now, is in a position to book small lots on the basis of delivery at the convenience of the mills. Sheets, which were generally sold at concessions in midsummer, are now exceedingly difficult to obtain, with the result that consumers, particularly the automobile manufacturers, are offering generous premiums to obtain their needs.

Market Sags at Cincinnati in Middle of Year

BY JAMES E. M'DONALD

IT is rather an odd coincidence that the price of No. 2 Southern iron in the month of January, 1919, was $31, Birmingham basis, the same as it was quoted during the first three weeks in November. The largest fluctuation in the value of Southern iron occurred in June, when some contracts were taken as low as $24, Birmingham. The year opened with Northern No. 2 foundry quoted at $31 at Ironton and in June it also dropped to about $26.

One effect of the war regulations is noted in the establishing of the base price for Southern iron on a silicon content of 1.75 to 2.25. After price restrictions were removed, all of the furnaces tacitly agreed to work on this basis.

The whole month of January was dull with the exception of some heavy buying of high phosphorus iron in the South by stove makers. Southern producers were hard put all during January and February to sell iron in competition with Northern producers and were unable to compete in price, except where freight rate differentials were in their favor.

During the first part of March the inquiry for foundry iron was very encouraging and silvery iron was also in big demand. However, the price fixing meetings in New York and Washington tended to act as the damper on business. The Valley furnaces were able to sell a few lots of foundry iron the latter part of March and the first part of April in this territory. However, this competition did not last very long.

In April the price of Southern iron receded to $30.35, Cincinnati, or $26.75, Birmingham. Northern iron was steady at $26.75, Ironton, and a fair-sized tonnage was disposed of for shipment before July 1.

Malleable Very Active

In May malleable was very active, although the sales made covered iron for shipment during May and June only. Prices in both the Northern and Southern districts on foundry iron were very unstable and some declines in both districts took place. A few of the Tennessee furnaces having favorable freight differentials gave their customers the benefit of these freight differences. Ohio silvery irons again showed activity and 8 per cent silicon was quoted at $40.25 furnace.

The tide seems to have turned in June and transactions in both Northern and foundry iron were heavy, although no improvement in price was noted until the last week of the month. A St. Louis melter put out an inquiry for 20,000 tons of basic and in July bought about half this tonnage from southern Ohio for third quarter shipment.

In the third week of July all Southern makers adopted the schedule price of $26.75, Birmingham, for foundry iron and in August a number of them made advances of from 50c. to $1 a ton. Labor troubles early in July closed down all the Jackson County, Ohio, silvery iron furnaces with the exception of one producer. This strike was not settled until the last week in November.

August was a dull month and while there were scattered inquiries for iron to be shipped through the first quarter and first half of 1920, the furnaces refused to make any prices for that delivery. The scarcity of high silicon iron became very acute and stocks in the South were drawn on for considerable tonnages.

Scarcity of Foundry Iron

The scarcity of foundry iron both in the Birmingham and Ironton districts occupied the attention of both buyers and sellers during the month of October and as prices advanced consumers bought iron freely when it could be obtained.

Pig-Iron Prices—Cincinnati

	Southern Foundry No. 2, f.o.b. Cincinnati	Northern Foundry No. 2, f.o.b. Cincinnati	No. 1 Railroad Wrought, Gross Ton	No. 1 Machinery Cast, Net Ton
January	$34.60	$32.80	$18.25	$21.50
February	34.60	32.80	14.37½	17.50
March	33.53¾	31.73¾	13.00	17.12½
April	30.35	28.55	13.50	17.00
May	29.95	28.15	14.00	17.00
June	28.21½	28.04	14.75	17.50
July	29.55	28.55	17.30	21.65
August	30.91¼	28.55	18.37½	22.37½
September	31.35	28.80	17.50	21.87½
October	31.60	31.20	17.50	20.00
November	34.35	34.80	18.75	23.25
December	38.60	38.80	20.12	27.12

Early in November practically all furnace stocks had been exhausted and as they had taken on all first quarter business they cared to handle, books were closed for any delivery. The Lake furnaces early in the fall sold some foundry iron in this territory, but not enough to relieve the shortage to any considerable extent. An Indiana melter bought 10,000 tons of mal-

leable, the larger part of the order going to a Lake producer.

Toward the latter part of the month practically all furnaces withdrew from the market for first quarter shipment, but early in December a few of them quietly offered iron, but considerably above the closing quotations of October. The average advance for November on both Northern and Southern iron was about $3 per ton and about the same for December.

The Jackson County Strike

The settlement of the strike at the Ohio silvery iron furnaces in Jackson County did not enable those furnaces to blow in during November or December, as the coal strike cut off coke supplies. However, considerable silvery iron had been piled on furnace yards which the producers were unable to load while the strike lasted at their plants, but practically all of this was due on old contracts. As a consequence Ohio silvery irons continued very scarce and only nominal quotations were named for future delivery. The furnaces also seemed reluctant to book business very far ahead and at the wind-up of the year were following in the footsteps of many foundry iron makers, who practically closed their books and are awaiting developments so as to ascertain more closely their production costs.

The accompanying table gives the actual invoice price of foundry iron as recorded by one firm, f.o.b Birmingham:

Average in Mill Price of Southern Foundry Iron, f.o.b Birmingham, in 1919

January	$32.451	June	$28.934
February	32.82	July	26.846
March	32.431	August	27.698
April	32.459	September	26.619
May	31.429	October	27.239

During the entire year there was a wide margin between scrap and pig iron prices. In the month of May scrap prices reached a very low mark and No. 1 machinery cast was bought freely around $17 per net ton.

Eastern Pennsylvania Iron and Steel Trade

BY C. E. WRIGHT

THE past year will go down in iron and steel trade history, along with 1917, as a period in which record-breaking prices for pig iron were paid. Predictions of $40 iron, which were made early in the year, were not fulfilled as quickly as expected, but the end of the twelve-month period finds quotations on all grades at very close to that figure, basic and gray forge having sold at close to the prices paid for foundry iron.

The first quarter of the year was characterized chiefly by hand-to-mouth buying, most consumers being fairly well covered as a result of their commitments entered into before the signing of the armistice. The $3 a ton reduction on all grades of iron, effective Jan. 1, created a disturbing situation for a time, as many consumers insisted on their contracts being written down to the new basis, and the same controversy came up again when the March 21 schedule of prices, promulgated by E. H. Gary, chairman United States Steel Corporation, was announced. This schedule, which was made public after the unsuccessful efforts of the Secretary of Commerce to stabilize prices by means of the ill-fated Industrial Board, was not universally adopted at once by Eastern furnace operators, but it became a basis for transactions for some months to follow. The eastern operators, when following this schedule, added the $3.90 freight rate from Pittsburgh, thereby putting iron prices on a Pittsburgh basis, as they were during the period of Government control.

In the months from March 21 to June, when buying of iron was at a comparatively low point, there were many recessions from this basis on sales for prompt delivery, but the Pittsburgh basis served to protect many furnaces on their contracts. In May many furnaces were out of blast and demand for iron began to catch up, to some extent, with the supply. A better buying movement developed in June, but prices in some transactions were below $28, furnace, for iron analyzing 2.25 to 2.75 per cent silicon. There was a marked tendency toward firmness in August, and in September the fear of a steel strike caused furnaces to go very slowly in selling at what might then have been considered low prices.

When the seriousness of the steel strike had been clearly established, the market took on an increasingly firmer tone, and this extended particularly to basic iron, which for many months had been weak. The American Bridge Co., not ordinarily a buyer of merchant iron, contracted for 45,000 tons of basic in October, which took a considerable part of the available supply for delivery over the remainder of the year. As the steel strike continued, the scarcity market developed more serious features; furnaces, which had sold up pretty well ahead, withdrew from the market; spot iron became more difficult to get; some furnaces showed no disposition to sell for 1920 delivery, and prices began their further upward trend. The coal strike added the only element needed to usher in a period of extremely high prices, and at the close of the year it was apparent that the top had not been reached, some predicting $50 iron as an almost assured thing for early in 1920.

The range of prices for pig iron in the Philadelphia market is shown by the following monthly averages, which are compiled from the weekly quotations in THE IRON AGE. With the exception of standard low phosphorus iron, the quotations represent prices for delivery at Philadelphia or nearby:

	Eastern Penna. No. 2X	Virginia No. 2X	Basic Delivered Eastern Penna.	Gray Forge Delivered	Standard Low Phos. F.O.B. Furnace
January	$36.15	$39.11	$33.90	$33.90	$51.00
February	36.15	36.35	33.90	33.90	51.00
March	34.39	35.89	32.84	32.84	49.94
April	31.90	31.72	29.65	29.65	46.75
May	30.70	31.60	29.65	29.21	46.75
June	29.50	30.60	26.54	26.25	40.19
July	29.08	30.60	26.12	25.92	35.60
August	29.60	32.85	26.60	26.60	36.50
September	30.70	33.10	26.60	26.98	38.00
October	32.10	34.35	28.00	28.69	37.00
November	35.35	34.47	30.38	32.40	39.50
December	40.10	42.47	35.00	36.92	44.25

Finished Steel

Buyers and sellers of finished steel products both had their inning in 1919, though conditions favored the buyers during the greater part of the period. It was not until after the effects of the steel strike had been felt that a strong seller's market developed, and then sellers were not in a position to take full advantage of it owing to the relatively small amount of steel they had for sale.

Following the uncertain conditions of the first two months, there came the efforts of Secretary of Commerce Redfield to establish an Industrial Board of the Department of Commerce, with control over prices. This price stabilization plan was expected to exert a strong influence in steadying the market and encouraging buyers to place their orders. In the latter months of the year, however, independent producers have shown no hesitancy in breaking away from these prices as conditions of supply and demand have enabled them quite easily to obtain more.

Eastern steel manufacturers have been foremost in adopting this independent attitude. Though there was some cutting of prices earlier in the year, particularly on plates, which sold freely for a time at 2.50c., Pittsburgh, the swing of prices to higher levels quickly followed the first evidences of a pronounced scarcity market. This upward trend of steel prices is of too recent occurrence to require reiteration here.

Semi-Finished Steel

During a greater part of the year the market for semi-finished steel was not active. Prices remained on the basis of $42.50, Philadelphia, from March 21, until the steel strike. Early in the year sales of forging

billets were frequently made at the price for re-rolling quality. When the scarcity of steel, resulting from the steel and coal strikes, had had its full effect, open hearth re-rolling billets were selling at $54, Philadelphia, and forging billets at $69, Philadelphia, these being the prices in effect at the close of the year.

Old Material

There were declining prices for iron and steel scrap in the early part of the year, due to lack of demand, heavy melting steel for delivery in Eastern Pennsylvania declining from $18 on Jan. 1, 1919, to a low price for the year of $15 in May. A better tone developed in June and an advancing tendency was noted in all grades of old material over the remainder of the year, with the exception of a slight reaction in September, when No. 1 heavy melting steel sold for $18.50, delivered. But this was followed by higher prices in October, resulting from increased demand because of the shortage of pig iron brought about by the steel strike. Prices remained strong throughout the remainder of the year and advanced to fairly high levels. No. 1 heavy melting steel at the close of the year was selling at $22.50, delivered, and other grades were proportionately high, foundry grades in particular being in good demand. The following table shows the monthly average prices for the year, as compiled from THE IRON AGE weekly quotations, on several grades of scrap. Similar averages on No. 1 heavy melting steel, No. 1 cast, machine shop turnings, cast-iron borings, No. 1 railroad wrought and carwheels will be found on another page of this issue.

	Low Phos. Scrap	Wrought Iron and Steel Pipe	Stove Plate	Railroad Malleable	Rerolling Rails
January	$24.40	$18.00	$18.40	$18.00	$22.20
February	20.50	17.25	18.00	18.00	17.37
March	20.62	16.50	18.00	18.00	16.25
April	22.50	18.00	17.30	18.00	17.50
May	22.37	17.87	17.00	18.00	17.50
June	22.50	17.75	17.25	18.00	18.12
July	23.00	18.80	18.40	18.40	20.30
August	24.62	19.50	20.12	20.00	25.00
September	25.00	19.50	20.00	20.00	25.00
October	24.40	18.70	20.50	20.00	24.20
November	25.50	19.87	21.12	20.75	28.12
December	27.00	21.75	22.50	25.50	31.25

The Sheet and Tin Plate Trades in 1919

The Industries Still Growing—Large Increases in Output Per Mill—High Cost of Labor

BY B. E. V. LUTY

FOR a long period of time many men were seriously engaged with the problem of devising mechanical methods for rolling sheets and black plates for tinning, as the large amount of hand labor involved in existing methods of operating sheet and tin mills appeared to present a fruitful field for invention. When these efforts began the writer does not know, but he does recall "writing up" one such "invention" more than a quarter century ago, and presumably there were others of earlier date. In the writer's review of the sheet and tin plate industries in THE IRON AGE of Jan. 7, 1904, there was given the first published description of the Bray equipment for semi-automatic rolling of sheets and of black plate for tinning, the American Sheet & Tin Plate Co. having at that time operated the Bray mill at the Monongahela tin plate works, Pittsburgh, for several months, while during 1904 the company proceeded with the installation of corresponding equipment for the rolling of sheets at Sharon.

At the present time, however, sheets and black plates are rolled in practically the same style as formerly. The steel is still handled by the tongs of workmen. The roller feeds the steel to the rolls, the "behinder"—as they call him in Wales—catches the piece or pack and passes it back over the rolls to the roller, the matcher and doubler handles the material with his tongs, and the heater usually performs much the same work as formerly, though there have been some important improvements in the heating furnaces.

In a general way it may be said that the efforts have failed, that the work of a quarter century ago is still done by hand, and not mechanically. Men do not always know, however, how they are going to succeed. Despite the apparent failure of the efforts referred to, the sheet and tin plate industries have really succeeded in their main objective, which was to produce the material in large tonnage at a reasonable cost. A long range comparison of what has been accomplished along this line is startling. Separate comparisons will be made as to tin plate mills and sheet mills.

At the beginning of 1904, there were 300 sheet mills completed and 43 being built, making a total of 343. Prior to 1913, the sheet mill production in gages below No. 13 was not reported, but it is sufficiently illuminating as to capacity to note that not until 1906 did the production of sheets, No. 13 gage and lighter, cross the million ton mark. At the present time there are about 494 jobbing and sheet mills, including a few mills operated "tin mill style," but making sheet specialties not intended to be tinned, and their capacity is easily far in excess of 2,500,000 tons. From 343 mills to 494 mills, however, is an increase of only 44 per cent.

At the beginning of 1904 there were 335 tin plate mills completed, with 63 building, making a total of 398. It was not until 1906 that tin plate production crossed the half million ton line. At the present time there are about 545 tin plate mills (not counting "tin" mills in sheet plants, which are included in the figures in the foregoing paragraph) and their capacity is easily 1,800,000 tons. The increase in the number of mills is only 37 per cent.

While there was an ambition, years ago, to reduce manual labor at the hot mills, what the sheet and tin plate industries have really done is to double the number of men per mill. In essence there are two complete crews who take turns at handling the material during their eight-hour shift. The mills have been so improved that the tonnage per mill is very greatly increased, while in various ways the work has been made easier for the men. The greatest single improvement has been the introduction of ventilating and cooling devices whereby the men perform their work under much more comfortable conditions.

Many years ago there was a labor union which restricted the output per mill. If that restriction had been persisted in, something would have had to go, either the union or the process. As it is, the men receive very good wages in all times. At the present very high rates, this tremendously expensive hot mill labor amounts, in the case of tin plate, to nearly a quarter of a cent on the material required to make a two-pound tin can! One can readily imagine how vastly the use of canned goods would be stimulated if the cost of this labor were reduced 25 or 50 per cent. Again, the hot mill labor cost bears heavily upon the poor purchaser of an automobile, for in the case of the heaviest cars it amounts to more than $5 per car, as much as one must pay for a headlight contraption or to get a 1920 license. For the ordinary cars it is somewhat less than $5, this covering frame stock and hood, radiator, fender, apron and body stock. How the automobile could be popularized by reducing the hot mill labor cost!

Thus the sheet and tin plate industries are not suffering from the failure of efforts to eliminate hand labor at the hot mills. The subject, indeed, has been

practically forgotten, but it is not unprofitable to reflect occasionally upon how viewpoints change.

The Sheet Market in 1919

Except for the setback caused by the strike in the iron and steel industry inaugurated Sept. 22, the sheet industry had a very good year from a tonnage standpoint. Sheet production had been greatly restricted in the closing months of the war and much demand had banked up. Another factor in giving the sheet mills a good demand was that there had been practically no building of sheet mills during American participation in the war. Indeed, since Jan. 1, 1917, to the present date, the increase in the number of sheet and jobbing mills and tin mills making sheet or black plate specialties has been only about 5 per cent.

The course of sheet prices was rather uneventful. There have been only two regular changes in market prices since the war control prices as is shown in the table below:

	War control	Dec. 12, 1918	Mar. 21, 1919
Blue annealed, 10 gage.....	4.25c.	3.90c.	3.55c.
Black, 28 gage.....	5.00c.	4.70c.	4.35c.
Galvanized, 28 gage.....	6.25c.	6.05c.	5.70c.

During the major portion of the second quarter of the year, there was more or less shading of sheet prices by a large number of producers, but several producers, including the American Sheet & Tin Plate Co., rigidly refrained from any price cutting. A very interesting circumstance was that many buyers of sheets elected not to avail themselves of the opportunity to buy in the open market at cut prices, but adhered to their regular sources of supply. They may not have expected great rewards, but the event proved otherwise, as the shortage of sheets developed during the strike caused many producers to advance their prices, particularly those who had previously been conspicuous as cutters, while the American Sheet & Tin Plate Co. and a few other producers rigidly adhered to the March 21 prices despite the fact that higher prices could readily be secured.

The war control price of sheet bars was $51. A reduction was made in December, 1918, to $47, while the March 21 reduction was to $42. Upon few, if any, occasions in 1919 did sheet bars sell at less than the last-named price. Thus a new element, introduced by the war-time control of prices, was perpetuated. Prior to the war the typical sheet mill usually had an advantage in its steel, comparing the cost at time of delivery with the open market price at the time. Forward contracts were made for sheet bars in advancing markets, and there were various conversion or ratio contracts. Thus it occurred that the sheet mills made profits at times when a comparison of open market prices for sheet bars and sheets, respectively, showed little if any margin beyond the actual cost of conversion. This fact needs to be taken into account in comparing recent sheet bar and sheet prices, otherwise the sheet mills will appear to have a larger margin of profit than is really the case. Toward the close of 1919 many sales of sheet bars were made at prices well above the $42 level, but certain of the producers were taking care of regular customers at the $42 price.

The Tin Plate Market in 1919

The effort during the war to insure an ample supply of tin plate for taking care of all the canning crops that could possibly be raised was extremely successful. The crops of 1918 did not reach the maximum provided for, and on account of shortage of labor much of the crops could not be packed. At the end of the canning season, or at the time of the armistice, there was a stock of tin plate in various hands of about 8,000,000 boxes, approximately one-fourth the year's production, and this stock had to be absorbed in 1919. The outlook appeared very gloomy, and in placing orders for the first half of 1919 the buyers were extremely conservative. The situation righted itself much more easily than had been expected, and before midsummer the mills had occasion to operate practically at capacity. The domestic market price seems to have been maintained quite well at all times. There was cutting for a time in the export market, even after the iron and steel strike had greatly curtailed the production. The war control price was $7.75 per base box, this being reduced to $7.35 in December, 1918, and to $7 March 21. This same price was adopted by the American Sheet & Tin Plate Co. and the independents as the basis for making contracts with customers for the forepart of 1920, for the first quarter in the case of jobbers and for the first half in the case of large manufacturing consumers.

During the war a number of tin plate mills discontinued the manufacture of terne plate entirely and few of these have resumed, the result being that terne plate is made now only by the leading interest and a very few of the independents, but a somewhat larger number make "long ternes." Prospects for terne plate consumption are good, however, and the next few years may see a considerably larger consumption of this form of roofing material than there was in the years before the war.

Number of Mills

The "tin" mill is somewhat differently listed by the American Sheet & Tin Plate Co. and the independents. A "tin" mill does not necessarily make black plate for tinning, the nomenclature referring to the style of working rather than to the use to which the product is put. A given stand of rolls may be changed from sheet mill style to tin mill style, or the reverse. The leading interest as a rule confines its production of tin mill sheets to its regular tin plate works, while the independent sheet plant frequently has one or more "tin" mills which do not make black plate for tinning at all. Hence it is awkward to attempt to list the Steel Corporation and the independent mills together.

The American Sheet & Tin Plate Co. carries on its tin mill list about 246 tin mills, all but one of the plants involved having tin houses. It has about 152 sheet mills and half a dozen jobbing mills on its sheet mill list. The count of tin mills sets a "double mill" as the equivalent of two single mills. The arrangement is frequently called the "Gary system," as it is used exclusively at the Gary plant, which originally contained 12 double mills, equal to 24 single mills. The plant is in process of being doubled, and about three of the new double mills are now in operation.

The number of independent mills of the various descriptions, in operation or in regularly operative condition, is approximately as follows:

Tin mills in tin plate plants.....	300
Tin mills in sheet plants.....	31
Sheet mills.....	307
Jobbing mills.....	23
Total mills in sheet plants.....	361

At least fifty sheet mills are now in process of construction by independent interests, with every prospect that in normal times the entire capacity of the sheet industry will be needed.

Production

Production in 1918, in gross tons, was as follows:

Sheets, 12 gage and thicker.....	405,563
Sheets, 13 gage and thinner.....	1,668,076
Tin mill specialties.....	102,898
Black plate for tinning.....	1,502,690
Tin plate.....	1,435,825
Terne plate.....	38,115
Tin and terne plate.....	1,473,939

No close estimates of production in 1919 can be made. The production of sheets, both light and heavy gage, and of tin mill specialties, was probably materially greater in 1919 than in 1918. The production of tin plate was probably a trifle less, but the terne plate output naturally increased, for in 1916 it was near the 100,000-ton mark, and its employment since the removal of war-time restrictions is naturally resumed. On the whole, the sheet and tin plate industries operated at considerably less discount from capacity in 1919 than was the case with the steel industry as a whole, which averaged for the year only about two-thirds of its full capacity.

Iron and Steel Prices for Twenty-One Years

Monthly Averages Computed from the Weekly Market Quotations of "The Iron Age" in the Period 1899-1919

(With Supplement)

Accompanying this issue of THE IRON AGE is our annual chart, in which lines are plotted to indicate the course of prices for pig iron, Bessemer steel billets and some leading forms of finished iron and steel in the 22 years ended with 1919. The diagrams are based on monthly averages of prices quoted week by week in our market reports from the leading selling centers. The table below, which gives the monthly average prices on which the chart is based includes also the average prices of No. 2 X foundry pig iron at Philadelphia, which have not been put in graphic form.

Bessemer Pig Iron at Pittsburgh, Dollars per Gross Ton (2240 lb.)

	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919
January	$10.87	$24.99	$13.15	$16.70	$22.15	$13.91	$16.85	$18.35	$23.15	$19.00	$17.34	$19.90	$15.90	$15.05	$18.15	$14.96	$14.59	$21.58	$35.95	$37.25	$33.60
February	11.60	24.80	14.43	16.93	21.45	13.66	16.41	18.35	22.85	17.90	16.78	19.34	15.90	14.90	18.15	15.09	14.55	21.51	35.95	37.25	33.60
March	14.59	24.72	16.31	17.37	21.85	14.25	16.35	18.28	22.85	17.86	16.25	18.60	15.90	15.09	18.15	15.09	14.55	21.75	37.70	37.25	32.54
April	15.03	24.70	16.75	18.75	21.28	14.18	16.35	18.19	23.35	17.49	15.78	18.27	15.90	15.15	17.90	14.90	14.55	21.95	42.20	36.15	29.35
May	16.20	21.00	16.30	20.75	20.01	13.60	16.16	18.10	24.01	16.93	15.84	17.52	15.90	15.13	17.70	14.90	14.59	21.95	45.15	36.15	29.35
June	18.51	19.72	16.00	21.56	19.72	12.81	16.65	18.23	24.27	16.90	16.05	16.60	15.90	15.15	17.14	14.90	14.70	21.95	54.70	36.38	29.35
July	20.65	16.75	16.00	21.60	18.89	12.40	14.85	18.41	23.55	16.83	16.46	16.40	15.90	15.20	16.70	14.90	14.95	21.95	57.45	36.60	29.35
August	21.75	15.60	15.75	21.62	18.35	12.81	15.20	19.00	22.90	16.23	17.03	16.09	15.90	15.46	16.52	14.90	15.95	21.95	54.75	36.60	29.35
September	23.43	13.87	15.75	21.75	17.22	12.63	15.91	19.54	22.90	15.90	18.05	15.90	15.90	16.15	16.65	14.90	16.85	22.26	48.03	36.60	29.35
October	24.18	13.06	15.89	21.75	16.05	13.10	16.54	20.35	22.00	15.71	19.53	15.90	15.44	17.80	16.60	14.84	16.95	24.08	37.25	36.60	29.35
November	24.78	13.48	16.00	21.68	15.18	14.85	17.85	22.85	20.65	16.59	19.90	15.82	15.00	18.02	16.02	14.59	17.51	30.15	37.25	36.60	31.26
December	24.90	13.43	16.31	21.75	14.40	16.65	18.35	23.75	19.34	17.40	19.90	15.90	15.03	18.15	15.77	14.70	19.65	35.68	37.25	36.60	36.65

Bessemer Steel Billets at Pittsburgh, Dollars per Gross Ton

January	$16.62	$34.50	$19.75	$27.50	$29.60	$23.00	$22.75	$26.25	$29.40	$28.00	$25.00	$27.50	$23.00	$20.00	$28.30	$20.13	$19.25	$32.00	$63.00	$47.50	$43.50
February	18.00	34.87	20.21	29.37	29.87	23.00	23.50	26.50	29.50	28.00	25.00	27.50	23.00	20.00	28.50	21.00	19.50	33.50	65.00	47.50	43.50
March	24.30	33.00	22.88	31.25	30.62	23.00	24.00	26.70	29.00	28.00	23.00	27.50	23.00	19.75	28.50	21.00	19.70	42.40	66.25	47.50	42.25
April	25.37	32.00	24.00	31.50	30.25	23.00	24.00	27.00	30.12	28.00	23.00	26.75	23.00	20.00	28.50	20.80	20.00	45.00	73.75	47.50	38.50
May	26.75	28.90	24.00	32.20	30.37	23.00	23.50	26.40	30.30	28.00	23.00	26.12	22.60	20.80	27.37	20.00	20.00	45.00	86.00	47.50	38.50
June	30.10	27.25	24.38	32.37	28.87	23.00	22.00	26.63	29.62	25.75	23.00	25.30	21.00	20.87	26.50	19.50	20.50	43.50	98.75	47.50	38.50
July	33.12	21.00	24.00	31.75	27.60	23.00	22.00	27.25	30.00	25.00	23.50	25.00	21.00	21.50	26.60	19.00	21.38	41.00	100.00	47.50	38.50
August	35.40	18.20	24.20	31.06	27.00	23.00	24.00	27.80	29.25	25.00	24.13	24.62	21.00	22.12	26.00	20.25	23.13	44.20	86.00	47.50	38.50
September	38.87	16.93	24.88	29.50	27.00	20.00	25.00	28.00	29.37	25.00	25.00	24.40	20.75	23.62	24.87	21.00	24.10	45.00	66.25	47.50	38.50
October	38.75	16.50	26.70	29.70	27.00	19.50	25.62	28.00	28.20	25.00	26.25	23.75	20.00	26.00	23.30	20.00	24.63	46.25	49.38	47.50	38.50
November	36.50	18.95	27.00	28.50	24.00	20.25	26.00	28.88	28.00	25.00	27.13	23.30	19.50	27.00	21.00	19.25	26.50	52.00	47.50	47.50	41.38
December	33.75	19.75	27.50	29.12	23.00	21.20	26.00	29.50	28.00	25.00	27.50	23.00	19.25	27.00	20.00	19.00	30.60	57.50	47.50	45.50	46.00

Basic Pig Iron, f.o.b. Mahoning or Shenango Valley Furnace, Dollars per Gross Ton

January	.....	.....	.....	.....	.....	.....	$15.46	$17.06	$21.90	$16.90	$15.50	$16.87	$13 25	$12.35	$16.41	$12.50	$12.50	$17.81	$30.00	$33.00	$30.00
February	.....	.....	.....	.....	.....	.....	15.25	16.82	22.00	15.97	15.12	16.31	13.65	12.25	16.30	13.19	12.50	17.69	30.00	33.00	30.00
March	.....	.....	.....	.....	.....	.....	15.55	16.85	21.50	15.62	14.94	16.00	13.75	12.81	16.11	13.00	12.50	18.20	32.25	33.00	28.94
April	.....	.....	.....	.....	.....	.....	15.06	16.88	21.50	15.25	14.05	15.94	13.75	13.00	15.87	13.00	12.50	18.13	38.75	32.00	25.75
May	.....	.....	.....	.....	.....	.....	15.06	17.00	22.90	14.91	14.12	15.19	13.32	13.00	15.15	13.00	12.50	18.00	41.60	32.00	25.75
June	.....	.....	.....	.....	.....	$11.76	14.60	16.94	22.40	15.25	14.62	14.70	13.05	13.12	14.50	13.00	12.59	18.00	48.75	32.00	25.75
July	.....	.....	.....	.....	.....	11.20	14.00	17.12	21.75	14.51	15.05	14.50	13.12	13.40	14.37	13.00	12.74	18.00	52.50	32.00	25.75
August	.....	.....	.....	.....	.....	11.69	14.32	17.70	21.25	14.60	15.25	14.12	13.00	13.94	14.06	13.00	14.06	18.00	51.20	32.00	25.75
September	.....	.....	.....	.....	.....	11.60	14.86	18.44	20.06	14.43	15.90	13.70	12.80	13.47	14.00	13.00	14.75	18.31	42.75	32.00	25.75
October	.....	.....	.....	.....	.....	12.19	15.25	19.55	19.50	14.04	16.94	13.15	12.52	15.98	13.90	12.81	15.00	19.88	33.00	33.00	25.75
November	.....	.....	.....	.....	.....	14.00	16.87	21.37	18.12	14.72	17.25	13.25	12.42	16.37	13.09	12.48	15.75	25.10	33.00	33.00	28.31
December	.....	.....	.....	.....	.....	15.70	16.75	21.50	17.50	15.60	17.05	13.40	12.25	16.50	12.71	12.50	17.50	30.00	33.00	33.00	34.25

Southern No. 2 Foundry Pig Iron at Cincinnati, Dollars per Gross Ton

January	$10.31	$20.69	$13.45	$14.55	$21.65	$12.37	$16.25	$16.75	$26.00	$16 15	$16.25	$17.25	$14.25	$13.25	$16.95	$13.88	$12.40	$17.90	$26.10	$35.90	$34.60
February	11.69	20.50	13.12	14.75	21.50	12.12	16.25	16.75	26.00	15.75	16.13	17.06	14.25	13.31	16.69	13.81	12.40	17.90	27.53	35.90	34.60
March	13.75	20.30	14.00	14.75	21.37	12.10	16 25	16.65	26.00	15.50	15.05	16.30	14.25	13.50	16.31	14.00	12.27	17.90	31.90	35.90	33.54
April	14.50	20.19	14.50	16.87	20.15	12.50	16.25	16.63	25.06	15.20	14.25	15.37	14.25	13.75	15.65	13.75	12.34	17.90	37.40	35.90	30.35
May	14.56	19.75	13.85	18.35	18.87	12.25	15.81	16.75	24.25	14.75	14.50	15.00	13.95	14.15	14.94	13.75	12.40	17.90	41.90	35.90	29.85
June	16.00	18.75	13.37	20.19	17.75	11.80	14.65	16.44	24.10	15.25	14.70	14.85	13.44	14.25	14.06	13.63	12.50	17.34	45.15	36.08	28.39
July	17.56	16.81	13.00	20.75	16.15	11.81	13.94	16.06	23.85	15.00	15.75	14.75	13.25	14.70	13.75	13.30	12.71	16.90	49.90	36.60	28.35
August	18.35	14.25	13.00	23.06	15.19	12.00	14.40	17.30	23.00	15.25	16.38	14.31	13.45	15.06	14.06	13.25	13.71	16.70	49.90	36.60	30.40
September	19.94	13.62	13.06	25.00	14.75	12.00	14.37	18.60	21.50	15.65	17.35	14.25	13.31	15.87	14.25	13.25	14.15	17.28	49.90	36.60	31.25
October	20.75	12.87	13.75	25.65	13.50	12.81	15.31	20.00	20.95	15.75	17.88	14.25	13.25	16.80	14.35	12.90	14.78	18.03	49.38	37.60	31.60
November	20.75	12.95	14.00	23.62	12.00	15.19	16.60	23.38	19.50	16.00	17.75	14.25	13.20	17.25	13.87	12.90	16.15	22.40	35.90	37.60	34.35
December	20.75	13.75	14.25	22.44	12.05	15.85	16.75	25.00	17.00	16.25	17.45	14.25	13.19	17.25	13.95	12.50	17.10	25.90	35.90	37.60	38.60

Local No. 2 Foundry Pig Iron at Chicago (at Furnace), Dollars, per Gross Ton

January	$11.47	$23.85	$15.10	$16.25	$23.45	$14.47	$17.85	$19.60	$25.85	$18.45	$17.35	$19.00	$15.50	$14.00	$17.90	$13.75	$13.00	$18.50	$30.00	$33.00	$31.00
February	12.47	23.85	14.60	16.85	23.35	13.91	17.85	19.41	25.85	18.16	16.75	19.00	15.50	14.00	17.31	14.00	13.00	18.50	32.00	33.00	31.00
March	14.95	23.85	15.60	18.51	23.22	14.05	17.80	19.35	26.10	17.85	16.50	18.30	15.50	14.00	17.25	14.25	12.95	18.70	36.00	33.00	29.94
April	15.47	23.72	15.85	18.97	22.87	14.35	17.60	19.10	26.35	17.73	16.50	17.50	15.00	14.00	17.00	14.25	13.00	19.00	39.25	33.00	26.75
May	15.72	22.65	15.85	20.85	20.72	13.85	17.60	18.90	26.85	17.63	16.50	17.06	15.00	14.50	16.00	14.06	13.00	19.00	43.80	33.00	26.75
June	17.95	20.72	15.35	21.85	19.85	13.70	17.00	18.54	26.60	17.73	16.50	16.75	15.00	14.50	15.62	13.69	13.00	19.00	51 00	33.00	26.75
July	19.22	18.60	15.35	21.60	18.25	13.60	16.47	18.60	25.55	17.55	17.00	16.56	14.87	14.70	14.70	13.75	13.00	19.00	55.00	33.00	26.75
August	20.65	16.25	15.35	22.10	17.22	13.60	16.60	19.45	24.85	17.35	17.13	16.50	14.50	15.37	15.00	13.69	13.44	18.40	55.00	33.00	26.75
September	22.22	15.35	15.35	23.35	16.41	13.85	16.60	20.16	24.10	17.05	18.70	16.40	14.50	16.00	15.00	13.25	13 90	18.13	54.67	33.00	26.75
October	23.35	14.85	15.10	23.35	15.70	14.10	17.66	21.48	22.45	16.85	19.00	16.06	14.46	17.00	15.00	12.94	14.63	19.63	33.00	34 00	27.75
November	23.45	14.85	15.23	23.35	15 10	15.98	19.15	24.70	20.66	17.10	19.00	16.00	14.09	17.75	14.87	12.56	17.13	25.80	33.00	34.00	31.00
December	23.85	15.10	15.85	23.35	14.81	16.95	19.60	25.85	18.80	17.35	19.00	16.00	14.09	18.00	14.30	13.00	18.10	29.50	33.00	34.00	38.75

Standard Brands Eastern Pennsylvania No. 2 X Foundry Pig Iron at Philadelphia, Dollars per Gross Ton

January	$11.44	$22.70	$15.50	$16.75	$22.45	$14.69	$17.50	$18.50	$24.80	$18.25	$17.25	$19.00	$15.50	$14.85	$18.25	$14.65	$14.25	$19.94	$30.10	$34.25	$36.15
February	11.06	22.56	15.31	17.19	22.25	14.50	17.50	18.50	25.87	18.25	17.00	18.69	15.50	14.85	18.25	14.94	14.25	20.00	31.88	34.25	36.15
March	14.70	22.31	15.12	18.81	22.25	14.80	17.56	18.35	25.00	18.12	16.37	8.00	15.50	14.92	17.77	15.00	14.25	20.05	37.31	34.25	34.39
April	15.75	21.75	15.46	19.62	21.87	15.00	17.75	18.44	24.81	17.65	16.20	17.75	15.50	15.00	17.40	15.00	14.25	20.50	41.38	34.25	31.90
May	15.81	20.60	15.19	19.75	20.06	14.75	17.81	18.50	25.55	16.94	16.06	17.00	15.50	15.18	16.75	14.81	14.25	20.50	43.60	34.25	30.70
June	17.25	18.75	15.06	20.94	19.19	14.50	16.75	18.44	24.62	16.62	16.42	16.55	15.25	15.31	16.19	14.75	14.25	19.94	48.19	34.29	29.50
July	19.44	16.37	15.00	22.30	18.10	14.31	16.12	18.25	23.06	16.50	16.50	16.25	15.00	15.70	15.60	14.75	14.31	19.75	53.13	34.40	29.08
August	20.65	16.15	14.97	22.00	16.87	14.25	16.25	19.00	21.90	16.50	17.00	16.00	15.00	15.87	15.60	14.75	14.94	19.55	53.00	34.40	29.60
September	22.75	15.56	14.80	22.00	16.12	14.25	16.43	20.44	20.50	16.62	18.05	16.00	15.00	16.59	15.83	14.75	16.00	19.50	51.67	34.40	30.70
October	22.75	15.00	15.25	22.12	15.20	14.43	17.25	21.12	19.85	16.75	18.69	15.81	15.00	17.60	15.95	14.63	16.25	20.31	34.25	38.85	32.10
November	23.40	15.35	15.37	23.37	15.00	15.75	18.05	23.30	18.94	17.00	19.00	15.68	14.95	18.25	15.56	14.50	17.12	24.90	34.25	39.15	35.35
December	23.25	15.62	15.75	23.00	15 00	16.90	18.25	24.00	18.84	17.25	19.00	15.50	14.85	18.25	15.20	14.25	19.05	29.25	34.25	39.15	40.10

Soft Steel Bars at Pittsburgh, in Cents per Pound

January	1.02	2.22	1.25	1.50	1.60	1.30	1.40	1.50	1.60	1.60	1.40	1.50	1.40	1.15	1.70	1.20	1.10	2.03	3.15	2.90	2.70
February	1.12	2.21	1.30	1.51	1.60	1.30	1.40	1.50	1.60	1.60	1.35	1.50	1.40	1.12	1.70	1.20	1.10	2.31	3.25	2.90	2.70
March	1.36	2.25	1.40	1.60	1.60	1.33	1.50	1.50	1.60	1.60	1.20	1.45	1.40	1.10	1.85	1.20	1.15	2.65	3.63	2.90	2.61
April	1.56	2.10	1.47	1.60	1.60	1.35	1.50	1.50	1.60	1.60	1.15	1.45	1.40	1.16	1.84	1.15	1.20	2.88	3.75	2.90	2.35
May	1.67	1.91	1.41	1.60	1.60	1.35	1.50	1.50	1.60	1.60	1.19	1.45	1.37	1.20	1.70	1.14	1.20	3.00	4.00	2.90	2.35
June	1.98	1.52	1.40	1.60	1.60	1.35	1.46	1.50	1.60	1.45	1.20	1.45	1.25	1.20	1.60	1.11	1.21	2.75	4.25	2.90	2.35
July	2.02	1.19	1.40	1.60	1.60	1.35	1.50	1.50	1.60	1.40	1.27	1.45	1.23	1.25	1.50	1.12	1.25	2.63	4.50	2.90	2.35
August	2.14	1.05	1.44	1.60	1.60	1.35	1.50	1.50	1.60	1.40	1.32	1.40	1.20	1.30	1.40	1.19	1.30	2.56	4.30	2.90	2.35
September	2.40	1.12	1.50	1.60	1.60	1.31	1.50	1.50	1.60	1.40	1.39	1.40	1.19	1.37	1.40	1.20	1.34	2.60	4.00	2.90	2.35
October	2.39	1.09	1.53	1.60	1.60	1.30	1.50	1.50	1.60	1.40	1.51	1.40	1.12	1.45	1.39	1.15	1.44	2.75	2.90	2.90	2.39
November	2.24	1.18	1.50	1.60	1.37	1.31	1.50	1.54	1.60	1.40	1.50	1.40	1.08	1.55	1.29	1.10	1.62	2.83	2.90	2.90	2.69
December	2.20	1.25	1.50	1.60	1.30	1.34	1.50	1.60	1.60	1.40	1.50	1.40	1.12	1.66	1.21	1.07	1.84	3.00	2.90	2.80	2.75

Tank Plates at Pittsburgh, in Cents per Pound

	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919
January	1.30	2.22	1.40	1.60	1.75	1.60	1.50	1.60	1.70	1.70	1.60	1.55	1.40	1.15	1.75	1.20	1.10	2.25	4.45	3.25	3.00
February	1.47	2.17	1.40	1.60	1.60	1.60	1.50	1.60	1.70	1.70	1.52	1.55	1.40	1.11	1.71	1.20	1.10	2.56	4.88	3.25	3.00
March	1.75	2.03	1.47	1.60	1.60	1.60	1.60	1.60	1.70	1.70	1.30	1.55	1.40	1.12	1.70	1.18	1.10	3.10	5.25	3.25	2.91
Apr l	2.05	1.87	1.57	1.60	1.60	1.60	1.60	1.60	1.70	1.70	1.27	1.55	1.40	1.21	1.63	1.15	1.15	3.56	5.88	3.25	2.65
May	2.12	1.69	1.60	1.60	1.60	1.60	1.60	1.60	1.70	1.70	1.29	1.51	1.39	1.25	1.60	1.12	1.15	3.75	6.60	3.25	2.65
June	2.32	1.39	1.60	1.69	1.60	1.60	1.60	1.60	1.70	1.62	1.25	1.48	1.35	1.25	1.45	1.10	1.18	3.63	8.00	3.25	2.65
July	2.45	1.16	1.60	1.75	1.60	1.60	1.60	1.60	1.70	1.60	1.33	1.41	1.35	1.30	1.45	1.10	1.22	3.44	9.00	3.25	2.65
August	2.55	1.09	1.60	1.75	1.60	1.60	1.60	1.60	1.70	1.60	1.40	1.40	1.34	1.35	1.44	1.18	1.26	3.70	8.80	3.25	2.65
September	2.85	1.11	1.60	1.75	1.60	1.44	1.60	1.60	1.70	1.60	1.46	1.40	1.29	1.47	1.40	1.20	1.34	4.00	8.00	3.25	2.53
October	2.79	1.07	1.60	1.84	1.60	1.40	1.60	1.60	1.70	1.60	1.50	1.40	1.17	1.53	1.36	1.14	1.44	4.00	3.25	3.25	2.61
November	2.52	1.31	1.60	1.82	1.60	1.40	1.60	1.62	1.70	1.60	1.54	1.40	1.13	1.59	1.26	1.08	1.65	4.15	3.25	3.25	2.65
December	2.30	1.39	1.60	1.82	1.60	1.45	1.60	1.70	1.70	1.60	1.55	1.40	1.15	1.60	1.20	1.05	2.04	4.25	3.25	3.13	2.65

Beams at Pittsburgh, in Cents per Pound

January	1.30	2.25	1.50	1.60	1.80	1.60	1.50	1.70	1.70	1.70	1.60	1.55	1.40	1.15	1.75	1.20	1.10	1.90	3.25	3.00	2.80
February	1.30	2.25	1.50	1.60	1.60	1.60	1.50	1.70	1.70	1.70	1.52	1.51	1.40	1.11	1.71	1.20	1.10	2.06	3.25	3.00	2.80
March	1.40	2.25	1.52	1.70	1.60	1.60	1.60	1.70	1.70	1.70	1.30	1.50	1.40	1.15	1.70	1.19	1.10	2.40	3.54	3.00	2.71
April	1.50	2.25	1.60	1.70	1.60	1.60	1.60	1.70	1.70	1.70	1.27	1.50	1.40	1.21	1.68	1.15	1.20	2.55	3.88	3.00	2.45
May	1.50	2.25	1.60	1.60	1.60	1.60	1.60	1.70	1.70	1.70	1.27	1.50	1.39	1.25	1.50	1.14	1.20	2.60	4.00	3.00	2.45
June	1.70	2.07	1.60	1.60	1.60	1.60	1.60	1.70	1.70	1.62	1.25	1.48	1.35	1.25	1.45	1.11	1.20	2.53	4.31	3.00	2.45
July	1.94	1.90	1.60	1.84	1.60	1.60	1.60	1.70	1.70	1.60	1.33	1.41	1.35	1.30	1.45	1.12	1.25	2.50	4.50	3.00	2.45
August	2.05	1.74	1.60	2.00	1.60	1.60	1.63	1.70	1.70	1.60	1.40	1.40	1.35	1.35	1.45	1.19	1.30	2.52	4.30	3.00	2.45
September	2.25	1.50	1.60	2.00	1.60	1.44	1.70	1.70	1.70	1.60	1.46	1.40	1.34	1.42	1.41	1.20	1.35	2.64	4.00	3.00	2.45
October	2.25	1.50	1.60	2.07	1.60	1.40	1.70	1.70	1.70	1.60	1.50	1.40	1.21	1.48	1.37	1.15	1.44	2.75	3.00	3.00	2.45
November	2.25	1.50	1.60	2.05	1.60	1.40	1.70	1.70	1.70	1.60	1.54	1.40	1.13	1.57	1.29	1.10	1.60	2.86	3.00	3.00	2.45
December	2.25	1.50	1.60	2.00	1.60	1.44	1.70	1.70	1.70	1.60	1.55	1.40	1.15	1.60	1.25	1.07	1.78	3.25	3.00	2.90	2.45

Wire Nails at Pittsburgh, per Keg of 100 Lb.

January	1.43	3.20	2.22	1.99	1.89	1.89	1.75	1.85	2.00	2.05	1.95	1.85	1.71	1.57	1.75	1.54	1.54	2.13	3.00	3.50	3.50
February	1.57	3.20	2.30	2.05	1.92	1.90	1.80	1.85	2.00	2.05	1.95	1.85	1.75	1.60	1.75	1.60	1.57	2.25	3.00	3.50	3.50
March	1.94	3.20	2.30	2.05	2.00	1.91	1.80	1.85	2.00	2.05	1.95	1.85	1.79	1.60	1.76	1.60	1.60	2.40	3.20	3.50	3.44
April	2.05	2.95	2.30	2.05	2.00	1.90	1.80	1.85	2.00	2.05	1.87	1.85	1.80	1.60	1.80	1.60	1.56	2.40	3.28	3.50	3.25
May	2.10	2.20	2.30	2.05	2.00	1.90	1.80	1.85	2.00	2.05	1.65	1.82	1.80	1.60	1.80	1.56	1.55	2.50	3.50	3.50	3.25
June	2.30	2.20	2.30	2.05	2.00	1.90	1.74	1.85	2.00	1.97	1.70	1.80	1.75	1.60	1.80	1.50	1.55	2.50	3.75	3.50	3.25
July	2.42	2.20	2.30	2.05	2.00	1.89	1.70	1.84	2.00	1.95	1.72	1.75	1.70	1.62	1.70	1.52	1.60	2.50	4.00	3.50	3.25
August	2.50	2.20	2.30	2.05	2.00	1.71	1.70	1.82	2.00	1.95	1.80	1.70	1.69	1.66	1.65	1.56	1.61	2.58	4.00	3.50	3.25
September	2.76	2.20	2.30	2.03	2.00	1.60	1.74	1.86	2.05	1.95	1.80	1.70	1.65	1.70	1.65	1.60	1.60	2.60	4.00	3.50	3.25
October	2.87	2.20	2.28	1.89	2.00	1.60	1.80	1.85	2.05	1.95	1.80	1.70	1.64	1.70	1.63	1.60	1.80	2.63	.....	3.50	3.31
November	2.95	2.20	2.17	1.85	1.97	1.62	1.80	1.88	2.05	1.95	1.80	1.70	1.55	1.70	1.59	1.50	1.87	2.85	3.50	3.50	3.50
December	2.95	2.20	1.99	1.85	1.87	1.73	1.80	2.00	2.05	1.95	1.85	1.70	1.53	1.72	1.55	1.51	2.04	3.00	3.50	3.50	4.12

In plotting the lines on the accompanying chart, those representing finished material have been derived by multiplying the market prices of finished material per pound by 2240. In the tables, however, while pig-iron and steel-billet prices are in dollars per gross ton, those that are given for finished material are in cents per pound.

Prices used in plotting the charts are for delivery in from one to three months, and thus do not represent the extreme prices paid at times for prompt delivery.

Developments in the Non-Ferrous Markets

BY EDWIN F. CONE

INDIVIDUALLY and collectively, features that have marked the course of the non-ferrous markets during 1919 have been influenced by the varying currents and conditions of readjustment following the World War. As the year drew to a close, practically none of the markets had fully recovered from the abnormal influences of war demand. Price fluctuations for the year were not violent in any metal. The principal factors of dominant effect on both values and output were the unusual number as well as the importance of the strikes that prevailed in other industries and the phenomenal fluctuation in foreign exchange values which by December had fallen to the lowest levels ever recorded.

Copper Buying Light in 1919

Consumption and therefore buying of copper during 1919, both for domestic and particularly foreign account, were a distinct disappointment. The momentum in production attained during 1918 was appreciably slackened early in 1919. This was aided later by strikes at mines and other centers. As the year progressed, however, output was increased moderately, but even then by the close of the year it was estimated that production exceeded consumption by 35,000,000 to 40,000,000 lb. per month.

The year opened with heavy stocks of copper on hand. Demand from Europe did not materialize nor were domestic users justified in proceeding on a peace time basis. As a result values gradually declined until early in March, they reached the low point of the year at 14.50c., New York, for electrolytic, and 15.25c. for Lake copper for early delivery. After this period there were three distinct buying moments which made their appearance, one late in March and early April, one in June, and one in December. The high level was reached in the latter part of July when electrolytic copper sold at 23.50c. and Lake copper at 23.75c., New York, for early delivery. In the latter part of the year, values again fell off until early in December the second low level of the year was reached at 18c., New York, for electrolytic and Lake copper. Contributing causes for this recession were the steel and coal strikes with the low values of foreign exchanges militating against foreign buying.

An interesting development was the European trip of the committee of the Copper Export Association formed late in 1918. This group returned late in March, producing little evidence of the possibility of a buying movement from that quarter though convinced of the need of the metal, particularly in Central Europe.

An arrangement with producers early in the year resulted in the sale by them of the Government stocks of copper, estimated at over 140,000,000 lb. These were disposed of by the end of July, although it had been understood that the sale was to be spread over a 15-month period.

One of the surprises of the year was the heavy buying of the metal by Japanese interests. While some of this was doubtless for speculative account in this country, statistics show that the exports of copper to Japan have been very heavy, far exceeding any similar outgo in previous years. The real reason for this has been and still is a mystery. To Nov. 1, 1919, Japan was credited with 63,131,603 lb. as exported from this country, or more than that country had absorbed in ten years previous to 1919.

The year closed with the market slightly stronger than in early December and with buying by exporters better than in some time. Demand from domestic consumers was also better. Authoritative estimates are that from 250,000,000 to 300,000,000 lb. have been contracted for in December of which about 50,000,000 lb. was for export. The outlook for 1920 was considered favorable, as it seemed certain that when exchange values had reasserted themselves, European demand would be heavy.

Three Factors Dominated the Tin Market

Three important factors controlled the course of the tin market in 1919. They were the extension of Govern-

ment war control of the industry until the middle of the year, the effect of the bitter longshoremen's strike in New York in October and the decline in the pound sterling as well as its phenomenal fluctuations late in the year.

Trading in tin was absolutely in the hands of Government agents until June 23, 1919, when all restrictions were virtually removed. During this time a fixed price, 72.50c. per lb., New York, ruled. The market was not left to its natural course until the 10,169 gross tons of tin, which had been allocated to American consumers, had been sold. From this time on the market gradually was allowed to resume its old course.

Early in December sterling exchange reached its lowest level and tin also sold at its lowest price for the year, or 52.87½c., New York, for spot Straits. As a rule future shipment tin commanded a slightly higher price than spot shipment, but this was also erratic, due to the exchange situation.

The imports to Dec. 1, 1919, had been only 29,956 gross tons as against 53,972 tons to Dec. 1, 1918. Of the 1919 imports 22,320 tons was credited to the Straits Settlements. The decline for the year was due to the Government restrictions early in 1919 when imports were not permitted.

Lead Market First to Stabilize

The lead market has generally been regarded as the first to stabilize itself after the war. Its course in 1919 has, however, been characterized by no eventful occurrences. Curtailment of the heavy rate of war output was the leading factor early in the year. Falling prices accompanied this movement and other conditions were similar to those in the other markets. The low price of the year was reached early in May, when the outside market fell to 4.77½c. per lb., New York, the quotation of the leading interest at that time having been 5c., New York. The other extreme in values came in the last week of the year when lead was selling at 7.50c., New York, by the American Smelting & Refining Co., and at 7.75c. to 8c. in the outside market.

A scarcity of the metal was the leading factor at the close of the year and prices were advancing. Not only were domestic sources curtailed, but labor troubles in Australia and Spain had limited supplies from those sources. Values in London had also increased, having been in December double those six months before. As the year closed production had shown considerable improvement, and it was believed that while prices might go to 8c., New York, or higher, there would be a decided decline by the spring of 1920.

In 1919 the American Smelting & Refining Co. made four reductions in itn price and 14 advances, the low level being 5c. per lb., New York, on April 9, 1919, and the high point 7.50c., New York, on Dec. 26.

Zinc Market Closely Analogous to Copper

For most of the year the zinc market was a close parallel with the copper market. Until late in the year it was a matter of recovery from conditions obtaining during the war. Production for munition purposes had been heavy in 1918 and the slowing down of output was no easy matter. As in copper so in zinc, production for much of the early part of the year was heavier than consumption.

The year opened with prime Western zinc selling at 7.95c. per lb., New York, or 7.60c., St. Louis, but from that time on the market gradually declined until the low point for the year was reached early in May, when 6.27½c., New York, was recorded. Production was gradually curtailed by this time and remained so more or less of the year.

In sympathy with the three distinct buying movements in copper, the zinc market advanced also at the same time. This was in May, July and December. The high value in May was 6.60c., New York, and in July it was 8.40c., New York, or 8.05c., St. Louis. In neither case, however, was the demand heavy. The steel strike in September was an adverse factor, but even then price recessions did not attain a lower level than 7.50c., New York. The coal strike did not last long enough to seriously affect this market.

The turn in the market for the better in 1919 may be said to have come in July. From that time on the market was a steady one. The most important factor, however, the latter part of the year was not domestic demand, but foreign buying. This came from both Japan and England, the latter country being estimated to have taken 10,000 to 12,000 tons per month. Exports to Nov. 1, 1919, have been 211,518,470 lb. or 30 per cent more than for the same period in 1918. Of the 1919 movement to Nov. 1, Japan has taken 29,000,000 lb. and England 92,800,000 lb. Declines in foreign exchange also had their effect the last four weeks of the year and temporarily interfered with the export buying movement.

The year closed with the tone of the market strong and with prices up to the highest point of the year or at 9.30c. to 9.40c., New York, and at 8.95c. to 9.05c., St. Louis.

Connellsville Coke Prices for Eighteen Years

We present below tables showing monthly prices of prompt shipment Connellsville furnace and foundry coke for 18 years, 1902 to 1919, inclusive, averaged from weekly quotations in THE IRON AGE.

Average Prices of Prompt Connellsville Furnace Coke, per Net Ton at Oven

	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919
January	$2.90	$5.00	$1.60	$2.46	$2.62	$3.53	$1.92	$1.59	$2.55	$1.40	$1.82	$3.88	$1.85	$1.50	$2.94	$9.50	$6.00	$5.65
February	2.50	5.00	1.52	2.56	2.14	3.50	1.86	1.59	2.12	1.45	1.78	2.52	1.85	1.50	3.38	9.62	6.00	4.44
March	2.87	5.00	1.65	2.43	2.24	3.02	1.72	1.60	2.00	1.55	2.12	2.40	1.90	1.50	3.47	9.60	6.00	4.06
April	2.50	4.20	1.60	2.07	2.45	2.72	1.57	1.60	1.77	1.59	2.39	2.15	1.86	1.50	2.41	7.38	6.00	3.65
May	2.50	3.50	1.50	1.87	2.46	2.16	1.50	1.57	1.66	1.50	2.28	2.13	1.77	1.50	2.30	7.80	6.00	3.69
June	2.69	3.00	1.45	1.82	2.32	1.89	1.55	1.52	1.65	1.42	2.02	2.11	1.75	1.56	2.49	11.25	6.00	4.00
July	3.00	2.50	1.45	1.81	2.51	2.40	1.57	1.58	1.59	1.44	2.21	2.45	1.75	1.64	2.75	12.75	6.00	4.07
August	3.87	2.25	1.45	1.80	2.76	2.62	1.50	1.66	1.57	1.46	2.21	2.50	1.70	1.50	2.80	13.60	6.00	4.31
September	5.00	2.20	1.45	2.10	2.85	2.82	1.50	2.39	1.60	1.50	2.37	2.29	1.65	1.61	2.94	11.12	6.00	4.56
October	8.00	1.90	1.47	2.61	2.84	2.85	1.53	2.76	1.59	1.50	3.41	2.98	1.60	2.03	4.88	6.00	6.00	4.52
November	6.00	1.75	2.04	2.95	3.13	2.41	1.72	2.74	1.50	1.52	3.94	1.82	1.52	2.28	6.90	6.00	6.00	5.87
December	6.00	1.62	2.12	2.79	3.52	2.06	1.82	2.67	1.44	1.60	4.00	1.75	1.50	2.64	8.38	6.00	6.00	6.12

Average Prices of Prompt Connellsville Foundry Coke, per Net Ton at Oven

	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919
January	$3.17	$6.50	$2.18	$2.38	$3.42	$4.25	$2.45	$2.00	$2.90	$1.90	$1.97	$4.40	$2.50	$2.00	$3.50	$9.75	$7.00	$6.25
February	3.50	6.50	2.10	2.68	2.65	4.00	2.39	1.95	2.70	2.10	2.09	3.25	2.50	2.00	3.50	11.00	7.00	5.00
March	3.50	6.50	2.25	2.75	2.78	3.65	2.25	1.95	2.60	2.05	2.56	3.00	2.45	2.00	3.75	11.60	7.00	4.94
April	3.12	5.50	2.15	2.70	2.95	3.31	2.22	1.86	2.45	2.00	2.69	3.00	2.40	2.00	3.56	9.13	7.00	4.30
May	3.15	4.50	2.00	2.55	2.81	3.00	2.03	1.85	2.20	1.81	2.58	2.85	2.40	2.00	3.25	8.90	7.00	4.31
June	2.87	3.50	1.90	2.40	2.65	3.00	2.00	1.80	2.17	1.76	2.40	2.80	2.32	2.00	3.25	11.72	7.00	4.56
July	3.20	3.25	1.80	2.35	2.79	3.00	2.00	2.00	2.15	1.82	2.40	2.70	2.22	2.05	3.25	13.25	7.00	5.00
August	4.25	3.00	1.75	2.25	3.00	3.08	1.92	1.95	2.15	1.85	2.40	2.90	2.25	2.00	3.30	13.20	7.00	5.25
September	6.00	2.87	1.85	2.50	3.19	3.20	1.90	2.55	2.12	1.85	2.54	2.90	2.10	2.07	3.31	11.75	7.00	5.80
October	9.00	2.87	2.00	3.00	3.31	3.25	2.10	2.90	2.10	1.81	3.65	2.81	2.00	2.35	3.88	6.60	7.00	6.25
November	7.00	2.50	2.25	3.50	4.00	2.75	2.20	3.25	2.05	1.85	4.25	2.60	1.92	2.88	7.10	7.00	7.00	7.00
December	7.00	2.25	2.35	3.50	4.12	2.50	2.25	3.20	1.97	1.90	4.50	2.50	1.90	2.95	8.63	7.00	7.00	7.00

Cast-Iron Pipe Prices—1900-1919

The accompanying diagrams show the course of prices for the past 20 years on 6-in. cast-iron water pipe, f.o.b. New York, in carload lots, per ton of 2000 lb. The table given below is presented for those desiring the data on which the pipe curve is constructed, but going back to 1900. The prices for the first ten years were furnished by Daniel Runkle, at that time with the Warren Foundry & Machine Co., 11 Broadway, New York, and for the remainder of the period covered were averaged from weekly quotations in THE IRON AGE:

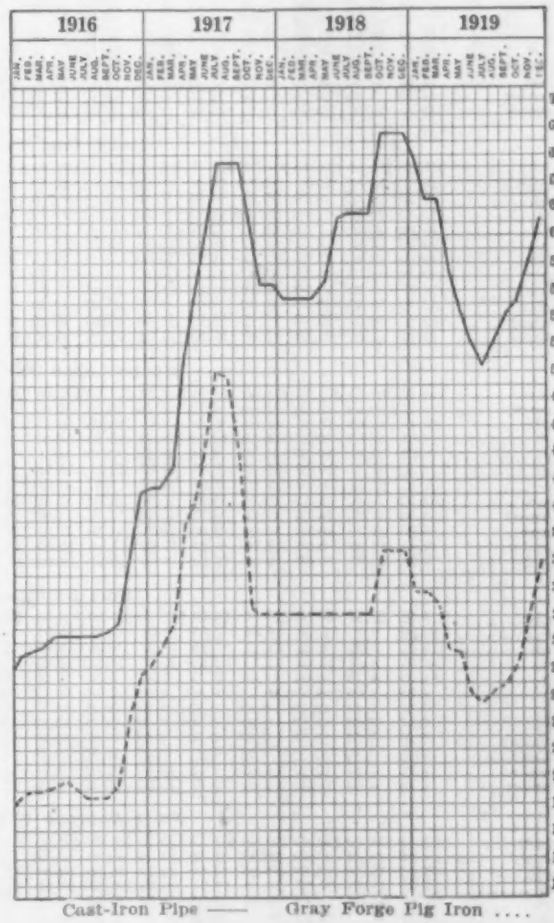
Cast-Iron Pipe Prices at New York, 6-Inch, per Net Ton

	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909
Jan...	$27.50	$21.75	$24.50	$29.25	$24.50	$28.00	$29.75	$34.25	$27 00	$24.50
Feb....	26.75	22.25	25.00	29.25	24.25	28.50	29.50	34.25	26.75	24.25
March.	26.75	21.50	26.25	30.75	24.25	26.75	30.50	34.00	26.25	25.25
April...	26.50	22.00	26.00	31.00	24.25	27.00	29.75	33.50	26.25	25.00
May...	26.00	22.25	27.75	30.75	24.00	27.25	31.00	34.25	26.25	25.25
June...	24.50	23.00	28.00	30.75	23.50	27.25	32.50	33.50	25.75	26.00
July...	24.75	23.75	28.50	30.75	23.50	27.25	30.25	34.00	25.75	26.25
Aug...	23.50	23.75	29.50	29.50	23.50	27.75	30.50	32.50	25.25	26.00
Sept...	22.25	23.50	29.50	29.00	23.00	27.25	31.00	33.00	25.75	25.75
Oct....	21.75	24.00	29 50	26.00	23.25	28.25	33.00	33.50	25.75	25.50
Nov...	21.75	24.50	30.75	24.50	25.00	29.00	33.25	28.50	25.00	25.87
Dec....	21.75	23.75	29.25	24.25	27.00	29.25	35.50	28.00	25.50	25.70

	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919
Jan....	$25.50	$22.00	$32.00	$25.00	$22.00	$20.00	$29.00	$41.50	$55.35	$65.70
Feb....	25.50	21.50	22.00	24.75	22.00	20.00	29.33	41.50	55.35	62.70
March.	25.50	21.00	22.00	23.87	22.00	20.00	29.75	43.10	55.35	62.70
April...	25.50	21.00	21.25	23.50	22.00	21.60	30.50	50.88	55.35	57.70
May...	25.50	21.00	21.00	23.00	20.88	22.00	30.50	55.50	56.60	54.45
June...	25.25	21.00	21.00	23.00	20.50	22.25	30.50	60.75	61.44	52.03
July...	24.00	21.00	22.10	23.00	20.50	22.50	30.50	65.50	61.75	50.46
Aug....	23.50	21.00	22.00	23.00	20.50	23.25	30.50	65.50	61.75	52.33
Sept...	23.50	21.00	23.12	23.00	20.40	24.37	30.83	65.50	61.75	54.30
Oct....	23.00	21.00	24.50	23.00	20.00	25.25	31.50	61.00	67.70	55.30
Nov...	22.12	21.40	24.12	23.00	20.00	26.50	35.50	56.50	67.70	58.30
Dec...	22.00	22.00	24.62	22.33	20.00	27.60	41.00	56.50	67.70	61.30

To show how closely cast-iron pipe prices follow the fluctuations in pig iron, we have added to the pipe curves another giving the course of prices on gray forge pig iron at Philadelphia and vicinity, as gray forge is largely used in making pipe. These prices, on which this curve is constructed, also going back to 1900, have been averaged from weekly prices in THE IRON AGE, and are in the table below.

Prices for the past four years have been plotted on a large scale to show in full detail the great increase on pipe and pipe iron costs that resulted from war conditions, especially in 1917, 1918 and 1919.



Detail Diagram of Course of Cast-Iron Pipe and Gray-Forge Iron Prices in Past Four Years Under Stimulus of War and Past Year of Readjustment

Gray Forge Pig Iron, Philadelphia and Vicinity, Gross Ton

	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919
January	$20.37	$14.50	$15.75	$21.75	$13.50	$16.25	$16.75	$23.50	$16.50	$16.25	$17.75	$14.25	$14.25	$17.65	$14.00	$13.50	$18.44	$28.38	$32.00	$33.90
February	20.25	14.50	15.75	21.25	13.50	15.75	17.00	23.50	16.50	16.25	17.50	14.25	14.25	17.31	14.00	13.44	19.00	29.75	33.00	33 90
March	19.25	14.00	17.50	20.00	12.75	16.25	16.75	23.50	16.50	15.50	16.90	14.60	14.25	16.87	14.00	13.25	19.00	31.94	33.00	32 84
April	18.75	14.37	18.25	20.00	13.75	16.25	16.75	23.00	16.00	15.00	16.62	14.73	14.37	16.56	14.00	13.25	19.13	38.50	32.00	29.65
May	18.00	14.37	19.00	19.50	13.75	16.00	16.50	23.25	16.00	15.00	16.00	14.70	14.50	15.81	13.81	13.25	19.50	40.40	32.00	29.21
June	16.50	14.37	19.25	18.25	13.50	15.75	16.25	23.00	15.25	15.25	15.65	14.50	14.62	15.37	13.75	13.25	19.25	44.31	32.00	26.25
July	14.50	14.12	21.75	18.12	13.25	14.50	16.10	22.50	15.25	15.50	15.37	14.50	14.87	14.95	13.75	13.25	18.50	50.05	32.00	25.92
August	14.50	14.00	21.00	15.50	12.50	15.00	16.50	20.50	15.25	16.25	15.00	14.30	15.37	14.62	13.75	14.50	18.50	49.56	32.00	28.60
September	14.00	14.00	21.00	14.75	13.00	15.00	17.75	19.50	15.50	17.00	14.75	14.45	15.87	14.56	13.75	15.13	18.50	44.25	32.00	27.00
October	13.50	14.12	21.00	14.50	12.75	15.75	18.25	18.75	15.50	17.50	14.50	14.25	16.87	15.00	13.62	15.25	19.35	32.20	36.00	28.69
November	14.00	14.37	22.00	14.00	14.00	16.25	20.00	17.00	15.75	18.00	14.37	14.25	17.62	14.75	13.50	16.05	23.75	32.00	36.00	32.40
December	14.50	14.87	22.25	14.00	15.50	16.50	22.00	16.75	16.00	18.00	14.25	14.25	17.75	14.58	13.50	17.63	27.00	32.00	36.90	36.10

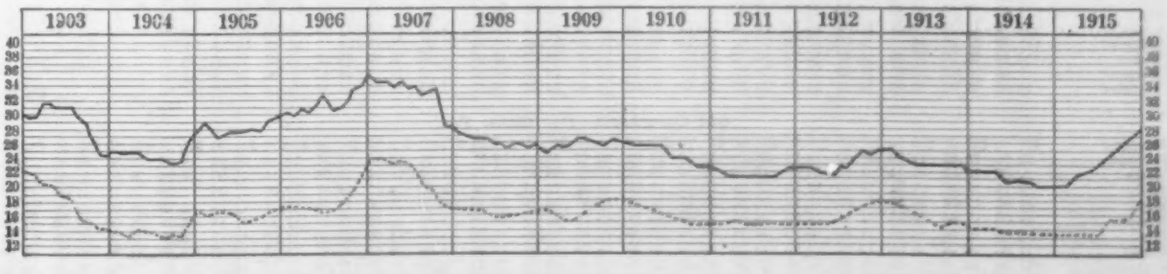


Diagram Showing the Fluctuation of Prices of Cast-Iron Water Pipe at New York for the Period 1903 to 1915, inclusive, Compared with Course of Prices on Gray Forge Pig Iron at Philadelphia. The pipe is 6-in., carload lots, prices per ton of 2000 lb. The heavy black line indicates the pipe prices and the dotted line the pig-iron prices.

Philadelphia Scrap Prices, 1900 to 1919

These Prices, Delivered Eastern Pennsylvania, Are Averaged from Weekly Quotations in THE IRON AGE

Heavy Melting Steel Scrap—Per Gross Ton

	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919
January	$20.00	$14.90	$18.30	$20.00	$11.56	$17.44	$17.33	$18.61	$11.70	$16.94	$17.00	$12.50	$12.19	$14.40	$10.40	$10.00	$16.38	$21.70	$30.00	$17.29
February	21.25	15.62	19.00	20.19	12.56	17.37	16.62	18.69	14.25	15.58	16.62	13.50	11.70	12.87	11.00	10.00	16.50	20.63	30.00	14.75
March	21.90	16.00	20.12	20.75	14.00	17.62	15.80	18.87	13.12	13.50	16.50	14.05	11.80	13.25	11.31	10.80	16.90	23.50	29.00	14.19
April	21.90	16.75	20.87	20.75	14.69	17.56	16.69	18.75	12.75	13.25	16.12	13.31	12.94	13.44	10.95	11.00	17.88	24.88	28.00	15.50
May	18.70	16.55	21.00	20.56	12.50	15.94	16.30	18.95	12.81	14.75	14.75	13.00	13.50	12.10	10.63	11.25	16.60	25.40	29.00	15.00
June	16.00	15.75	20.94	20.50	11.35	14.55	15.75	18.75	13.25	15.81	14.45	13.00	13.50	11.75	10.50	11.10	15.31	34.13	29.00	16.12
July	11.50	15.81	21.00	19.00	11.12	15.16	15.87	17.62	13.80	15.80	14.12	13.19	13.50	11.35	10.30	12.06	14.94	35.20	29.00	18.90
August	10.80	16.70	20.50	17.37	11.75	15.55	16.75	16.85	14.50	16.87	13.75	13.15	13.65	11.43	10.19	13.75	14.75	31.88	29.00	19.37
September	12.56	16.44	20.50	15.87	11.90	15.69	17.94	16.50	15.19	17.40	13.85	12.50	14.50	11.62	10.69	15.00	14.75	30.25	29.00	18.62
October	12.62	17.50	20.55	13.85	12.87	16.56	18.12	15.35	15.00	18.00	13.81	11.94	15.10	11.15	9.95	14.75	15.63	25.00	29.00	19.10
November	14.40	17.19	20.50	11.87	14.75	17.55	18.70	12.94	15.75	18.00	13.50	11.55	15.50	10.19	9.25	14.65	20.13	26.00	28.00	20.62
December	16.75	17.81	20.25	11.25	16.20	17.50	19.50	11.50	17.10	17.50	12.65	12.08	15.25	10.00	9.40	15.81	23.75	28.20	25.00	22.50

Heavy Cast Scrap—Per Gross Ton

January	$17.37	$14.50	$14.40	$19.75	$12.75	$16.00	$16.00	$21.70	$15.30	$15.87	$17.00	$14.00	$13.42	$14.50	$12.00	$12.00	$17.00	$20.20	$30.00	$23.80
February	17.37	14.00	14.81	19.81	12.81	15.62	15.87	22.00	15.00	15.00	16.12	14.38	13.00	14.37	12.88	12.00	17.00	20.00	30.00	23.00
March	17.15	14.00	16.00	20.00	13.30	15.75	15.50	22.25	15.00	14.00	16.00	14.40	13.12	14.00	13.00	12.00	17.00	21.75	30.00	21.25
April	16.62	14.00	17.06	20.00	13.37	16.00	15.50	21.25	15.00	14.10	15.87	13.44	13.62	13.94	13.00	11.75	17.88	26.63	29.00	22.00
May	15.60	13.95	17.70	19.25	12.50	15.19	15.40	20.80	14.87	14.69	15.06	13.13	13.75	13.60	12.25	12.13	17.50	29.00	29.00	21.50
June	14.00	13.52	18.25	18.37	11.60	14.20	15.37	20.75	14.25	15.00	15.00	13.00	13.75	13.25	12.00	12.25	16.50	33.50	29.00	22.00
July	13.00	13.62	17.75	17.50	11.25	14.00	15.12	19.25	14.00	14.85	14.94	13.06	13.75	13.00	12.00	12.38	16.00	36.30	29.00	22.10
August	13.30	13.75	18.25	15.87	11.50	14.40	16.30	18.60	14.25	15.37	14.25	13.20	13.75	12.87	12.00	13.30	16.00	33.25	29.00	24.75
September	14.37	13.75	19.00	14.75	11.50	15.12	17.44	18.00	15.25	15.90	14.00	12.69	14.96	12.81	12.00	14.00	16.00	31.00	29.00	25.00
October	13.50	13.75	19.50	13.90	12.37	15.75	18.37	17.60	15.25	16.94	14.00	12.44	14.50	13.50	11.40	14.00	16.15	28.00	29.00	25.20
November	13.69	14.00	19.50	12.87	13.75	16.00	19.20	16.50	15.44	17.50	14.00	12.25	14.75	12.62	11.00	14.50	18.50	30.00	29.00	27.62
December	14.12	14.00	19.50	12.50	14.90	16.00	21.12	15.50	16.00	17.50	14.00	13.00	15.00	12.17	11.30	16.06	20.75	30.60	29.00	30.75

Machine Shop Turnings—Per Gross Ton

January	$15.12	$9.85	$12.95	$16.00	$8.94	$14.50	$14.50	$16.05	$9.00	$13.63	$14.38	$8.12	$9.00	$11.20	$7.30	$8.00	$11.13	$12.90	$19.00	$12.60
February	15.25	10.00	13.50	16.00	9.12	15.75	13.81	16.25	9.87	12.00	13.50	9.19	9.25	10.37	9.00	8.00	9.38	12.38	18.63	10.25
March	15.10	10.89	14.44	16.50	9.45	15.19	13.55	16.75	9.62	10.08	12.80	10.00	8.80	10.12	8.75	8.13	10.25	14.13	18.25	11.00
April	14.94	12.00	16.37	16.50	10.12	14.75	13.81	16.55	8.40	10.10	11.44	8.81	9.69	10.31	7.90	8.25	11.00	15.25	18.50	11.80
May	13.90	12.00	16.20	15.75	9.50	13.50	13.19	16.95	9.12	11.62	9.94	8.25	10.40	9.20	7.50	8.44	11.75	16.00	18.50	10.62
June	11.00	11.56	16.00	15.12	8.20	11.00	12.31	16.94	9.50	12.50	9.65	8.40	10.31	8.00	7.69	8.50	8.63	20.25	18.50	11.75
July	8.75	11.50	16.50	14.40	7.94	10.66	11.69	15.37	9.80	12.45	9.62	9.00	10.50	7.85	7.75	8.63	8.50	23.70	18.50	13.50
August	8.20	11.50	16.12	13.00	8.56	12.90	12.65	14.30	10.75	13.50	8.81	9.30	10.65	8.00	7.94	9.80	8.05	20.75	18.50	15.00
September	8.50	11.56	16.00	11.00	8.75	13.62	13.75	14.00	11.50	14.35	8.75	8.19	10.94	8.00	8.56	10.56	7.44	20.38	18.75	15.00
October	8.50	11.75	16.00	10.50	9.00	14.25	14.25	12.85	11.80	15.50	8.62	8.00	11.40	7.85	7.90	10.13	10.13	18.00	19.00	15.10
November	8.85	12.25	16.00	9.75	9.62	14.40	13.85	10.50	12.94	15.06	8.50	8.00	11.50	7.00	11.50	10.25	10.38	18.00	19.00	17.00
December	9.75	12.75	16.00	9.19	12.50	14.50	15.94	9.00	13.90	14.15	8.15	8.91	11.00	7.08	7.65	11.00	13.50	18.20	18.00	18.50

Cast Borings—Per Gross Ton

January	$13.62	$7.94	$8.00	$10.00	$6.50	$11.19	$11.00	$13.55	$7.00	$12.62	$12.22	$8.12	$8.31	$10.85	$7.80	$8.00	$11.50	$13.94	$17.00	$11.00
February	12.50	8.00	8.00	10.69	7.00	11.25	10.31	14.50	8.37	11.00	11.50	8.81	8.00	10.37	9.19	8.00	11.00	13.38	17.38	9.50
March	13.60	8.00	8.62	11.12	7.35	11.31	9.85	15.37	7.75	8.17	11.20	9.60	8.50	10.06	8.94	8.00	11.00	15.00	17.50	9.50
April	13.25	8.37	10.00	11.55	7.56	11.25	10.25	15.69	7.50	8.65	10.38	8.25	9.37	10.25	8.30	8.00	11.38	15.63	17.50	13.30
May	11.50	8.75	10.05	11.06	6.75	9.87	9.50	16.00	8.12	9.87	9.84	7.75	9.60	9.17	8.00	8.00	12.75	16.10	17.50	12.50
June	8.25	8.00	10.37	10.31	6.35	8.00	9.37	16.12	8.75	10.50	8.80	7.91	9.50	8.25	8.00	8.10	10.00	21.50	17.63	12.75
July	7.62	7.81	10.50	9.40	6.12	7.83	9.31	14.37	9.00	10.40	9.50	8.63	9.56	7.85	8.00	8.50	10.00	25.00	18.00	13.80
August	6.55	7.25	10.12	8.31	6.50	9.20	10.25	13.50	10.00	11.44	9.31	8.80	9.75	7.94	8.50	9.80	9.50	22.25	18.38	14.62
September	6.69	7.31	10.00	7.50	6.75	9.87	11.25	12.81	11.00	12.45	9.2	7.69	10.06	8.18	8.56	10.44	9.13	22.00	18.75	15.25
October	6.75	7.50	10.00	7.15	7.11	9.87	11.37	11.20	11.25	13.37	9.06	7.50	10.85	7.90	8.00	10.25	10.10	19.20	19.00	17.30
November	7.25	7.87	10.19	6.81	7.75	10.60	12.50	8.37	12.00	13.19	8.50	7.50	11.37	7.50	7.50	10.05	11.63	20.00	19.00	19.62
December	7.75	8.00	10.00	6.44	9.80	10.50	13.00	7.00	12.75	12.10	8.15	8.09	10.83	7.17	7.65	11.00	14.50	20.00	17.00	21.75

No. 1 Railroad Wrought—Per Gross Ton

January	$22.75	$18.00	$20.00	$22.40	$15.12	$20.75	$21.16	$22.55	$14.30	$19.50	$19.56	$15.63	$15.37	$16.10	$13.05	$12.00	$22.00	$26.60	$35.00	$24.20
February	23.00	18.12	21.00	22.87	15.75	21.50	19.87	21.50	15.94	17.75	18.94	16.06	14.00	15.12	14.38	12.00	21.63	25.50	35.00	21.50
March	23.00	19.50	22.50	23.25	17.20	22.37	19.20	21.12	15.31	15.00	19.00	17.20	14.12	15.25	14.00	12.50	22.13	30.75	35.00	20.25
April	23.00	19.50	24.37	23.45	17.75	22.50	20.00	20.50	15.00	15.25	18.69	16.06	15.44	15.37	13.25	12.69	23.38	36.00	35.00	21.60
May	21.60	19.00	23.60	22.50	15.75	18.75	19.20	20.60	15.00	17.12	17.50	15.25	15.75	15.00	12.63	12.94	22.50	41.40	34.00	21.00
June	16.25	18.12	23.37	20.87	13.00	16.00	17.87	20.75	15.25	18.19	16.70	15.00	15.44	14.75	12.50	13.00	20.50	51.25	34.00	21.50
July	14.75	17.50	23.00	19.40	12.69	16.16	17.50	19.12	15.95	1 .45	16.00	15.13	15. 0	13.90	12.20	13.44	19.50	50.00	34.00	24.40
August	13.70	18.00	23.00	17.50	13.44	18.80	19.70	18.30	17.50	18.87	15.37	15.70	15.80	14.00	12.00	14.95	20.20	45.00	34.00	26.50
September	14.37	17.87	23.75	17.00	14.45	20.50	21.25	18.00	18.25	19.95	16.10	14.75	16.31	14.68	12.38	16.50	20.00	44.00	34.00	26.50
October	14.87	18.20	23.70	16.50	15.37	21.62	22.25	17.50	18.30	20.75	16.19	13.94	16.80	14.00	11.80	16.13	21.63	37.20	34.00	26.90
November	16.50	19.75	22.50	15.25	17.00	22.70	22.25	15.75	19.19	20.75	16.00	13.85	17.06	13.00	11.50	16.50	24.13	35.00	34.00	28.37
December	17.62	20.00	22.00	14.50	19.10	21.87	23.25	14.62	19.95	19.50	15.90	15.00	16.25	12.75	11.50	20.06	26.75	35.00	33.00	30.25

Old Iron Axles—Per Gross Ton

January	$26.25	$20.00	$24.20	$29.00	$15.50	$23.12	$27.50	$31.00	$23.00	$24.25	$28.00	$26.00	$22.25	$26.20	$21.00	$17.50	$27.00	$43.40	.....	.....
February	26.00	20.00	24.50	29.25	18.25	23.25	26.50	31.00	23.00	22.00	27.62	26.00	22.00	27.00	23.00	17.50	27.00	43.00	.....	.....
March	26.00	21.50	25.50	30.00	20.10	25.25	24.60	31.00	21.00	18.00	27.60	26.00	22.00	27.00	22.25	17.50	27.00	43.00	.....	.....
April	25.50	22.00	26.25	30.00	21.75	26.00	25.62	30.37	20.00	18.10	28.00	25.00	23.37	26.75	21.00	17.50	28.00	46.00	.....	.....
May	23.00	21.70	27.40	29.00	18.75	24.50	25.50	30.70	20.00	20.75	26.50	24.25	23.00	26.00	20.00	17.50	28.00	47.00	.....	.....
June	17.75	21.50	29.00	26.75	16.80	21.80	25.00	31.12	20.00	22.25	26.50	24.00	23.25	25.50	20.00	17.50	28.00	47.00	.....	.....
July	15.50	21.50	29.00	24.80	17.25	21.33	25.12	29.00	20.80	23.50	26.50	24.25	24.00	25.00	20.00	17.75	28.00	.....	.....	.....
August	15.00	22.40	29.50	20.62	17.62	24.00	27.40	28.30	22.25	24.00	26.50	24.50	24.00	25.00	20.00	20.60	28.00	.....	.....	.....
September	15.00	22.00	29.25	29.25	18.10	25.00	29.87	27.50	22.50	26.30	26.50	24.00	24.12	25.00	19.75	22.00	34.25	.....	.....	.....
October	15.75	23.50	30.00	18.80	19.25	26.12	31.00	27.20	22.50	29.00	26.50	23.50	24.70	25.00	17.80	22.00	35.00	.....	.....	.....
Novemb r	18.80	23.75	29.25	17.50	20.44	27.30	31.30	24.50	23.25	30.00	26.50	21.50	26.00	21.00	17.50	25.75	45.00	.....	.....	.....
December	20.00	24.00	29.00	15.62	23.10	27.12	32.00	23.00	23.95	30.00	26.50	21.50	26.00	21.00	17.50	25.75	45.00	.....	.....	$45.00

Old Steel Axles—Per Gross Ton

January	$27.25	$17.00	$19.00	$25.00	$14.25	$20.12	$20.62	$22.30	$18.10	$22.50	$23.00	$19.50	$17.25	$19.80	$15.50	$13.38	$25.00	$43.40	.....	.....
February	27.00	17.00	.....	25.25	16.00	20.25	19.87	21.81	18.00	20.50	22.62	20.12	17.00	19.00	16.75	13.50	25.00	43.00	.....	.....
March	27.00	17.00	22.00	26.00	17.00	21.25	19.30	22.00	17.62	17.00	22.40	20.80	17.00	19.00	16.25	14.00	25.00	43.00	.....	.....
April	27.00	17.00	24.33	26.00	18.00	22.25	20.12	21.62	17.50	17.05	22.00	20.00	17.00	19.0	15.05	14.00	26.00	46.00	.....	.....
May	24.20	17.00	25.40	26.00	15.50	19.62	19.60	21.80	17.62	18.75	20.62	19.31	17.00	17.70	14.00	14.00	26.00	47.00	.....	.....
June	16.00	17.00	27.00	23.00	15.00	17.30	19.25	21.80	18.00	20.50	20.50	19.25	17.25	17.50	14.00	14.00	26.00	47.00	.....	.....
July	16.00	17.00	27.50	21.80	14.75	17.00	18.75	20.25	18.00	21.30	20.12	19.37	17.50	17.50	14.00	14.25	26.00	.....	.....	.....
August	17.00	17.00	26.25	19.50	14.62	20.10	20.75	20.20	19.62	21.87	20.00	19.50	17.50	17.50	14.50	17.60	30.00	.....	.....	.....
September	15.00	17.50	26.00	18.00	15.20	21.00	22.25	20.00	21.25	22,90	20.00	19.00	18.00	18.12	14.81	19.50	34.25	.....	.....	.....
October	15.40	19.00	25.90	16.40	16.25	21.12	23.87	20.00	21.25	23.62	20.00	18.00	18.70	18.10	13.60	19.50	35.00	.....	.....	.....
November	17.00	19.00	25.25	14.50	17.87	21.50	23.30	19.62	21.62	24.00	20.00	17.20	19.75	16.44	13.00	20.70	40.00	.....	.....	.....
December	17.00	19.25	25.00	14.12	18.70	21.50	24.50	18.50	22.20	24.00	19.50	17.25	20.00	15.56	13.00	25.00	45.00	.....	.....	$34.00

Old Carwheels—Per Gross Ton

January	$20.50	$17.00	$16.95	$20.30	$12.87	$16.00	$18.75	$23.00	$18.20	$16.00	$17.50	$13.00	$12.37	$16.20	$12.20	$11.00	$16.38	$21.50	$30.00	$24.60
February	22.00	16.87	17.00	22.62	13.00	16.00	18.75	23.00	16.62	15.50	16.81	13.44	12.00	15.37	12.63	10.63	16.50	20.50	30.00	23.00
March	22.00	16.50	17.44	24.50	13.20	16.70	17.70	23.62	15.00	14.00	16.75	14.00	11.94	15.00	12.50	11.00	16.70	21.50	30.00	23.00
April	22.75	16.75	17.75	24.20	13.50	17.00	16.75	24.00	14.00	14.05	16.06	13.19	12.87	14.87	12.00	11.00	17.38	25.75	29.00	23.10
May	21.20	17.50	19.50	23.62	12.00	16.00	16.75	24.80	14.00	14.25	15.12	13.00	13.90	13.75	11.75	11.38	16.70	28.00	29.00	21.00
June	18.00	17.50	19.75	21.87	11.20	14.90	16.69	25.37	13.75	15.00	14.90	13.10	14.00	13.12	11 19	11.55	16.38	34.00	29.00	22.00
July	18.00	17.50	20.60	21.30	10.75	14.25	16.19	25.00	13.50	15.05	14.25	12.94	14.00	12.30	11.00	12.38	15.63	36.20	29.00	23.20
August	17.00	16.70	20.00	19.12	11.25	15.20	16.75	23.90	14.75	15.62	13.94	13.00	14.05	12.37	11.25	13.25	15.50	34.50	29.00	24.50
September	17.50	16.50	20.00	18.25	11.80	15.50	18.27	23.00	15.00	16.80	13.75	12.56	14.25	12.75	11.25	14.00	15.50	32.50	29.00	24.50
October	15.75	16.20	19.25	16.40	12.37	16 37	20.94	22.40	15.00	17.50	13.75	11.75	14.87	12.46	10.10	13.75	15.88	29.00	29.00	24.50
November	16.50	16.12	20.50	14.43	13.81	17.10	22.00	19.00	15.62	17.50	13.50	11.35	15.00	12.00	9.50	14.05	18.88	31.25	29.00	27.75
December	17.00	16.75	20.00	12.75	14.60	18.12	23.00	19.00	16.00	17.50	13.25	12.33	15.50	12.00	10.00	15.63	22.38	32.40	28.00	30.50

Scrap Prices at Chicago 1904 to 1919

These Prices Are Averaged from Weekly Quotations in THE IRON AGE

Heavy Melting Steel Scrap, per Gross Ton

	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919
January	$10.13	$14.88	$14.95	$16.80	$11.05	$13.94	$16.00	$11.75	$10.75	$12.60	$9.35	$9.19	$15.50	$21.12	$30.00	$17.40
February	10.88	14.13	13.63	15.75	12.50	13.56	15.50	12.06	10.75	12.13	10.50	9.56	14.75	21.50	30.25	15.06
March	11.50	14.45	13.00	16.00	11.44	12.13	15.00	12.15	10.94	12.08	9.81	9.63	16.50	23.70	29.87	15.63
April	11.25	14.38	13.50	15.75	11.05	12.35	14.44	11.75	11.56	12.50	9.80	9.15	16.50	27.00	28.75	16.41
May	9.75	12.55	13.70	15.60	10.62	13.44	13.56	10.50	12.05	11.25	9.69	9.37	15.94	28.70	28.80	15.62
June	9.30	11.95	13.13	16.25	11.62	14.50	13.15	10.38	12.12	10.44	9.75	9.44	14.80	36.50	29.00	16.69
July	9.00	12.75	13.13	16.12	11.75	14.06	12.38	10.69	11.69	10.50	9.75	10.40	14.50	33.00	29.00	19.40
August	9.25	13.15	14.10	15.10	12.88	15.00	12.25	11.05	12.25	10.56	9.69	11.56	15.25	29.60	29.00	20.88
September	10.00	14.38	16.50	14.75	13.00	16.00	12.25	10.70	12.81	10.06	9.19	11.75	16.06	31.25	29.00	19.10
October	10.88	14.50	16.60	14.70	13.45	16.43	12.25	10.00	13.95	10.00	8.50	11.75	16.81	26.00	29.00	18.25
November	12.55	15.20	17.50	12.63	14.88	16.00	12.25	9.75	13.69	9.56	8.06	13.44	20.60	27.60	28.50	20.88
December	14.15	15.25	17.13	11.50	15.17	16.00	12.10	10.25	12.88	9.00	8.43	15.63	23.00	28.37	22.75	21.80

Old Steel Rerolling Rails, per Gross Ton

January	$11.75	$16.00	$16.50	$19.00	$12.30	$15.81	$18.00	$13.69	$13.00	$16.15	$11.10	$9.62	$17.06	$27.00	$35.00	$22.10
February	13.13	15.13	16.25	19.00	13.00	15.12	18.00	13.63	12.80	15.50	11.81	9.87	17.06	27.00	35.00	16.44
March	13.00	15.30	15.70	19.00	12.19	13.06	17.80	13.65	12.75	15.00	11.56	10.25	17.65	28.00	34.75	16.38
April	13.00	15.44	15.75	18.50	12.60	13.20	17.69	13.44	12.88	14.63	11.50	10.25	18.00	32.62	33.50	17.55
May	11.88	14.06	16.00	18.60	12.94	14.44	17.12	13.49	13.50	13.95	11.31	10.25	17.38	36.50	34.00	17.75
June	10.80	12.95	15.88	18.94	13.94	15.50	16.50	12.38	13.50	12.69	11.50	10.25	15.85	46.90	34.00	18.75
July	10.31	13.56	15.50	18.00	14.50	15.40	15.88	12.25	13.50	12.25	11.50	10.30	15.25	45.19	34.00	25.15
August	11.50	14.35	15.90	17.00	15.63	16.12	15.31	12.65	14.00	12.12	11.50	12.25	15.80	39.20	34.00	29.50
September	11.81	15.25	17.63	16.75	16.18	17.15	15.25	12.75	15.00	12.25	10.75	13.35	17.06	39.75	34.00	26.80
October	12.38	15.63	18.63	17.15	15.80	18.00	15.25	12.44	16.30	12.15	10.00	13.31	18.81	34.75	34.00	27.19
November	14.75	16.30	21.15	15.06	17.19	18.00	15.06	12.30	16.50	12.00	9.50	14.44	24.50	34.80	33.50	31.25
December	16.00	16.50	21.00	12.94	16.95	18.00	14.20	12.50	16.50	11.33	9.50	16.63	28.63	35.25	27.50	31.90

Old Iron Rails, per Gross Ton

January	$14.00	$21.13	$23.00	$27.40	$15.60	$18.81	$20.00	$15.00	$15.19	$17.05	$13.00	$11.38	$17.50	$27.00	$37.80	$28.10
February	16.50	20.00	21.75	25.50	17.12	18.25	19.25	15.25	15.25	16.25	13.13	11.63	17.56	27.00	38.00	22.75
March	16.60	19.60	20.75	25.00	15.44	16.94	19.00	15.35	15.31	16.25	12.94	12.00	17.40	27.60	38.50	21.50
April	16.88	19.75	20.88	24.88	15.00	16.10	18.50	14.69	15.56	16.19	12.75	11.85	18.00	31.25	38.00	22.10
May	15.88	18.50	21.25	24.50	14.81	16.63	17.62	14.69	16.25	15.90	12.75	12.39	17.60	34.10	38.00	21.50
June	14.65	17.15	21.25	24.50	15.50	17.00	17.00	14.38	16.25	14.75	12.75	12.25	18.13	45.00	38.00	21.50
July	14.13	17.81	21.25	23.75	15.90	17.00	16.75	14.25	16.25	14.00	12.15	12.25	18.50	44.37	38.75	23.30
August	15.32	19.35	21.90	20.65	16.56	18.38	16.25	14.25	16.30	14.00	12.00	12.25	18.55	41.30	39.00	26.00
September	16.00	20.88	23.50	20.25	17.35	19.20	16.00	14.50	16.88	14.00	11.70	13.25	19.00	43.37	39.00	24.70
October	16.69	22.13	26.00	20.05	18.00	20.75	16.00	13.88	17.95	13.90	11.13	13.50	20.44	36.00	39.00	24.25
November	20.13	22.90	28.00	17.63	18.38	20.62	16.00	14.75	18.25	13.50	11.00	14.94	24.00	35.10	38.50	26.88
December	22.00	23.00	28.00	15.50	19.50	20.00	15.70	15.00	17.68	13.16	11.00	16.00	28.50	37.00	34.25	28.10

No. 1 Railroad Wrought, per Net Ton

January	$10.85	$18.19	$17.30	$16.35	$11.20	$13.81	$14.88	$11.75	$11.63	$12.70	$8.70	$8.69	$15.88	$23.50	$31.25	$19.10
February	12.50	17.00	15.88	15.50	12.44	12.88	14.69	12.00	11.30	12.19	9.50	8.87	14.94	23.75	31.25	15.13
March	12.80	16.40	14.88	15.25	11.25	11.43	14.45	12.30	11.44	12.13	9.06	9.00	16.20	25.90	30.75	15.88
April	12.50	16.06	14.50	15.25	11.00	11.90	14.19	11.69	12.31	12.38	9.00	8.65	17.00	30.35	30.20	16.05
May	11.38	14.19	14.50	15.45	10.75	12.81	12.87	11.38	12.75	11.25	9.00	8.94	16.50	32.60	29.75	15.69
June	10.50	13.50	13.50	16.06	11.69	13.38	12.75	11.25	12.57	10.56	9.00	9.00	15.20	41.00	29.75	16.87
July	10.44	14.13	13.50	15.06	12.15	13.16	12.44	11.00	12.06	10.55	9.00	9.15	14.94	37.75	29.75	18.60
August	11.13	15.45	14.50	14.40	12.69	14.44	11.94	11.10	12.50	10.62	8.94	10.44	15.30	33.70	29.75	20.75
September	11.85	16.31	16.13	14.38	13.44	15.35	11.94	10.94	13.13	10.19	8.37	11.00	16.38	35.50	29.75	19.50
October	12.50	17.00	17.50	14.60	13.60	15.94	11.75	10.44	14.25	9.60	7.87	11.19	17.50	28.75	30.36	19.38
November	15.44	17.50	18.00	12.32	14.38	15.31	11.94	10.20	13.50	9.00	7.56	12.94	21.00	30.90	28.68	22.88
December	17.55	18.00	17.25	11.00	14.83	14.75	11.65	10.75	13.06	8.50	7.90	15.38	25.13	31.25	24.62	24.10

Heavy Cast Scrap, per Net Ton

January	$10.50	$13.81	$14.70	$17.80	$12.95	$13.06	$14.88	$12.19	$11.25	$12.90	$10.20	$9.19	$13.31	$15.50	$25.90	$22.95
February	11.38	13.13	13.50	18.25	13.00	12.75	14.88	12.13	11.25	12.69	10.87	9.00	12.81	15.37	26.06	20.00
March	12.00	13.40	12.75	19.50	12.12	12.19	14.50	12.25	11.31	12.50	10.37	9.00	13.45	16.90	27.25	21.63
April	11.13	13.81	12.94	18.88	12.05	12.60	13.69	11.81	12.06	12.44	10.25	9.00	12.88	20.43	27.12	21.45
May	10.25	12.50	13.40	18.55	11.50	13.31	13.13	11.00	12.20	11.60	10.06	9.00	12.56	23.20	26.70	20.12
June	8.80	12.40	13.50	18.94	12.00	13.81	13.00	10.75	11.81	10.63	9.75	9.00	11.75	30.00	27.12	20.75
July	8.94	13.38	13.50	18.44	12.15	13.44	13.00	10.50	11.75	10.70	9.65	9.25	11.50	29.25	28.06	23.30
August	9.88	13.20	14.00	16.75	12.75	14.06	12.75	10.55	12.15	10.87	9.50	9.62	11.50	24.20	29.10	24.50
September	10.70	13.38	15.38	16.81	12.88	14.75	12.75	10.10	12.81	10.62	9.19	10.10	12.13	23.75	30.00	24.20
October	10.05	13.63	15.90	16.25	13.25	15.63	12.50	10.25	14.20	10.40	9.00	10.50	13.50	20.50	30.36	25.00
November	12.69	14.30	17.50	14.00	13.75	15.12	12.50	10.35	13.50	10.06	8.56	12.13	15.55	22.00	28.87	28.12
December	14.15	15.00	17.50	13.00	13.92	14.75	12.30	11.00	13.25	9.83	9.00	13.75	16.25	23.50	25.75	32.35

Railroad Malleable Scrap, per Net Ton

January	$8.25	$14.06	$15.00	$17.20	$10.40	$12.88	$15.00	$10.94	$10.88	$13.40	$9.25	$8.13	$13.81	$17.75	$26.80	$17.60
February	9.50	13.69	14.25	16.00	11.31	12.38	14.69	10.50	10.30	13.00	10.38	8.00	12.32	17.21	26.80	14.87
March	10.00	13.44	13.00	16.25	10.00	11.50	14.50	11.00	10.44	13.00	9.56	7.94	13.95	17.95	27.89	16.13
April	10.00	13.25	13.38	16.38	10.10	11.25	13.69	11.00	11.19	13.19	9.15	8.00	13.89	20.37	28.25	15.80
May	9.38	12.38	13.50	16.25	9.81	12.38	12.94	10.38	11.55	12.10	9.13	8.74	13.44	23.30	29.30	15.25
June	8.20	11.90	13.50	17.50	10.25	12.94	12.20	10.10	11.75	11.06	9.00	8.13	11.78	31.62	29.50	16.00
July	8.25	12.31	13.38	16.75	11.40	12.75	11.25	10.00	11.75	10.60	9.00	8.90	11.63	30.12	29.71	18.70
August	8.44	13.15	13.60	16.00	12.06	13.69	11.00	10.05	12.05	10.38	8.88	10.00	11.25	29.70	30.36	20.50
September	9.20	14.19	15.00	16.00	12.38	15.15	11.20	10.00	12.56	10.19	8.25	10.25	11.50	30.75	30.36	18.95
October	9.88	14.25	15.13	16.20	12.45	15.25	11.00	9.69	13.75	9.65	7.90	10.25	12.38	25.25	30.36	19.06
November	11.80	14.55	17.30	12.25	13.44	15.13	11.25	9.50	13.56	9.31	7.75	11.38	16.00	25.60	29.18	23.12
December	13.56	15.00	18.00	10.50	13.70	14.95	11.25	10.06	13.50	9.00	7.95	13.75	18.00	27.35	22.75	25.70

Frogs, Switches and Guards, Cut Apart, per Gross Ton

January	.....	.....	$14.88	$15.00	$17.40	$11.40	$14.00	$16.00	$11.50	$10.50	$12.65	$9.30	$9.19	$15.50	$21.60	$30.00	$17.40
February	.....	.....	14.06	14.75	16.25	12.38	13.56	15.50	11.88	10.50	12.13	10.50	9.86	14.75	21.69	29.75	15.06
March	.....	.....	14.50	13.70	16.50	11.69	12.50	15.00	12.10	10.88	12.13	9.81	9.63	16.50	23.70	29.87	15.38
April	.....	.....	14.25	13.50	16.50	11.50	12.55	14.50	11.63	11.38	12.44	9.90	9.15	16.50	26.75	29.00	16.15
May	.....	.....	13.31	13.70	16.90	11.56	13.44	12.69	10.38	11.80	11.30	9.69	9.38	15.94	28.70	29.00	15.63
June	.....	.....	12.10	13.13	17.25	11.63	14.50	13.15	10.20	11.88	10.44	9.69	9.44	14.63	36.50	29.00	16.69
July	.....	.....	12.75	13.25	16.81	12.30	14.15	12.38	10.44	11.56	10.50	9.75	10.45	14.50	33.00	29.00	19.40
August	.....	.....	13.15	14.30	15.50	14.00	14.88	12.25	10.70	11.95	10.56	9.69	11.56	15.25	29.60	29.00	20.88
September	.....	.....	14.38	16.62	15.50	13.63	15.95	12.25	10.38	12.63	10.19	9.19	11.75	16.06	31.25	29.00	19.10
October	.....	.....	14.50	17.13	15.30	13.85	16.62	12.25	9.94	13.75	10.00	8.75	11.75	16.81	26.00	29.00	18.25
November	.....	$13.25	15.40	18.30	12.69	14.50	16.06	12.25	9.65	13.44	9.56	8.19	13.44	20.95	27.60	28.00	20.88
December	.....	14.38	15.50	18.00	11.63	14.95	16.00	12.10	10.13	12.63	9.00	8.40	15.63	23.25	28.37	22.75	21.80

Old Carwheels, per Gross Ton

January	$13.26	$16.56	$19.00	$24.90	$20.10	$15.75	$18.38	$13.00	$13.25	$16.95	$11.65	$9.94	$14.63	$18.87	$30.00	$25.90
February	14.13	16.38	19.00	23.50	16.94	15.25	17.88	13.00	13.05	16.75	12.44	10.00	13.94	18.25	30.00	22.75
March	14.50	15.75	18.60	23.88	15.50	14.69	17.00	13.25	13.00	16.75	11.88	9.94	14.30	20.25	30.00	21.50
April	14.00	15.88	18.75	25.00	14.00	14.50	16.50	13.25	13.25	16.75	11.55	9.75	13.88	23.62	29.00	21.50
May	13.13	14.81	19.00	25.20	12.88	14.81	15.75	12.75	13.90	15.05	11.50	9.75	12.95	27.35	29.00	21.25
June	11.20	14.25	18.00	25.38	13.00	15.81	15.50	12.55	14.13	13.94	11.50	10.19	12.44	39.00	29.00	22.00
July	10.63	14.38	18.00	24.25	13.20	16.00	14.81	12.50	13.88	12.90	11.25	11.30	12.50	35.25	29.00	23.95
August	11.13	14.95	18.50	24.50	15.50	16.25	14.50	12.85	13.70	12.75	11.25	11.04	11.60	30.40	29.00	26.25
September	11.10	15.75	19.75	24.50	15.50	18.05	14.00	12.81	14.38	12.63	11.06	11.80	11.69	31.87	29.00	24.90
October	12.00	16.00	19.31	24.38	15.25	18.31	14.00	12.50	16.00	12.10	10.65	12.00	12.94	25.75	29.00	24.88
November	14.25	17.10	22.60	23.13	15.50	18.50	13.50	12.10	16.69	12.00	9.81	13.31	17.30	28.15	29.00	28.62
December	16.25	18.75	25.00	22.00	16.00	18.50	13.50	13.06	16.75	11.88	9.69	14.56	21.25	31.00	26.75	31.10

Foundry Iron Prices, Cincinnati and Chicago

The tables given below show the average monthly prices of No. 2 Southern pig iron at Cincinnati from 1880 to 1919, inclusive, and No. 2 local foundry pig iron at Chicago from 1889 to 1919.

Southern No. 2 Foundry Pig Iron at Cincinnati, per Gross Ton

	1880	1881	1882	1883	1884	1885	1886	1887	1888	1889	1890	1891	1892
January	$37.75	$22.50	$25.50	$21.62	$17.25	$15.62	$17.00	$20.12	$18.62	$14.75	$18.05	$13.81	$13.75
February	41.12	22.50	25.50	21.50	17.00	15.25	17.00	21.00	19.00	14.37	17.75	13.75	13.62
March	38.12	22.50	24.90	20.60	17.75	14.62	17.00	21.00	18.50	14.50	16.00	14.00	13.10
April	33.50	22.50	23.50	20.62	17.87	15.15	17.00	21.00	17.75	14.25	14.31	13.75	13.00
May	26.25	22.25	23.00	20.25	17.25	15.00	16.37	20.50	16.75	14.00	14.25	14.00	12.81
June	23.25	22.00	22.00	19.50	17.25	15.25	16.12	19.40	15.75	13.68	14.75	13.75	12.81
July	22.60	21.50	22.25	19.00	16.62	14.81	15.37	19.50	15.50	14.12	14.75	13.75	12.40
August	24.00	21.50	22.60	18.50	16.00	14.87	15.25	20.00	15.80	14.50	14.75	13.50	12.17
September	24.00	21.75	22.62	18.50	15.87	15.00	16.75	20.00	16.50	14.50	14.25	13.50	12.00
October	23.50	22.00	22.37	18.50	16.25	15.00	17.00	19.75	16.50	15.31	14.25	13.75	12.25
November	22.00	24.50	22.00	18.50	16.18	15.50	17.75	19.50	15.65	16.62	14.25	14.00	12.50
December	22.25	25.00	22.00	18.37	16.25	16.37	18.60	18.87	15.50	17.56	14.00	13.75	12.50

	1893	1894	1895	1896	1897	1898	1899	1900	1901	1902	1903	1904	1905
January	$12.50	$11.00	$9.25	$11.20	$11.00	$9.50	$10.31	$20.69	$13.45	$14.55	$21.65	$12.37	$16.25
February	12.12	10.75	9.25	11.00	9.75	9.25	11.69	20.50	13.12	14.75	21.50	12.12	16.25
March	12.00	10.20	9.25	10.75	9.69	9.25	13.75	20.30	14.00	14.75	21.37	12.10	16.25
April	11.75	9.50	9.25	10.40	9.25	9.25	14.50	20.19	14.50	16.87	20.15	12.50	16.25
May	11.68	9.50	9.50	10.50	8.75	9.37	14.56	19.75	13.85	18.35	18.87	12.25	15.81
June	11.50	9.61	10.12	10.32	8.75	9.30	16.00	18.75	13.37	20.19	17.75	11.80	14.65
July	11.37	9.75	11.50	9.75	8.95	9.25	17.56	16.81	13.00	20.75	16.15	11.81	13.94
August	11.05	9.80	11.50	9.37	9.00	9.37	18.35	14.25	13.00	23.06	15.19	12.00	14.40
September	10.75	10.00	12.75	9.50	9.35	9.55	19.94	13.62	13.06	25.00	14.75	12.00	14.37
October	10.75	10.00	12.75	9.95	9.50	9.75	20.75	12.87	13.75	25.65	13.50	12.81	15.31
November	10.75	9.75	12.75	10.44	9.50	9.75	20.75	12.95	14.00	23.62	12.00	15.19	16.60
December	10.87	9.25	12.50	10.35	9.50	9.90	20.75	13.75	14.25	22.44	12.05	15.85	16.75

	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919
January	$16.75	$26.00	$16.15	$16.25	$17.25	$14.25	$13.25	$16.95	$13.88	$12.40	$17.40	$26.10	$37.60	$34.60
February	16.75	26.00	15.75	16.13	17.06	14.25	13.31	16.69	13.81	12.40	17.75	27.53	37.60	34.60
March	16.65	26.00	15.50	15.05	16.30	14.25	13.50	16.31	14.00	12.27	17.90	31.90	37.60	33.53
April	16.63	25.06	15.20	14.25	15.37	14.25	13.75	15.65	13.80	12.34	17.90	37.40	37.60	30.55
May	16.75	24.25	14.75	14.50	15.00	13.95	14.15	14.94	13.75	12.40	17.90	41.90	37.60	29.95
June	16.44	24.10	15.25	14.70	14.85	13.44	14.25	14.06	13.37	12.50	17.45	45.15	37.60	28.21
July	16.06	23.85	15.00	15.75	14.75	13.25	14.70	13.75	13.30	12.71	16.90	49.90	37.60	29.25
August	17.30	23.00	15.25	16.38	14.31	13.45	15.06	14.06	13.25	13.71	16.70	49.90	37.60	30.91
September	18.69	21.50	15.65	17.35	14.25	13.31	15.87	14.25	13.25	14.15	17.28	49.90	37.60	31.35
October	20.00	20.95	15.75	17.88	14.25	13.25	16.80	14.35	12.90	14.78	18.03	35.90	37.60	31.60
November	23.38	19.50	16.00	17.75	14.25	13.20	17.25	13.87	12.90	16.15	22.40	35.90	37.60	34.35
December	25.00	17.00	16.25	17.45	14.25	13.19	17.25	13.95	12.50	17.10	25.90	35.90	35.90	38.60

Local No. 2 Foundry Pig Iron at Chicago (at Furnace after 1907), per Gross Ton

	1889	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899	1900	1901	1902	1903
January	$16.00	$19.50	$14.60	$14.50	$13.37	$12.50	$9.75	$13.55	$11.02	$11.35	$11.47	$23.85	$15.10	$16.25	$23.45
February	15.00	18.87	15.00	14.37	12.81	11.87	9.75	12.50	11.00	11.28	12.47	23.85	14.60	16.85	23.35
March	15.00	17.62	15.00	14.00	13.00	11.30	9.81	12.00	10.88	11.10	14.95	23.85	15.60	18.51	23.32
April	15.00	16.62	15.12	14.00	13.00	10.50	10.25	12.00	10.75	11.26	15.47	23.72	15.85	18.97	22.87
May	15.00	16.20	15.00	14.00	12.96	10.50	10.25	11.69	10.38	11.35	15.72	22.65	15.85	20.85	20.72
June	14.50	16.00	15.00	14.00	13.00	10.50	10.88	11.50	10.25	11.35	17.95	20.72	15.35	21.85	19.85
July	14.87	16.00	15.15	14.00	12.79	10.12	12.13	11.25	10.25	11.35	19.22	18.60	15.35	21.60	18.25
August	15.10	16.00	15.00	13.75	12.75	10.00	13.20	11.18	10.25	11.35	20.65	16.25	15.35	22.10	17.22
September	15.50	16.00	15.00	13.50	12.75	10.00	13.63	10.75	10.40	11.35	22.22	15.35	15.35	23.35	16.41
October	17.00	16.00	15.00	13.50	12.75	10.00	14.00	10.88	11.00	11.35	23.35	14.85	15.10	23.35	15.70
November	17.62	15.75	14.94	13.50	12.75	9.70	14.00	11.19	11.00	11.35	23.45	14.85	15.23	23.35	15.10
December	18.66	15.37	14.62	13.50	11.69	9.75	14.00	11.25	11.00	11.35	23.85	15.10	15.85	23.35	14.81

	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919
January	$14.47	$17.85	$19.60	$25.85	$18.45	$17.35	$19.00	$15.50	$14.00	$17.90	$13.80	$13.00	$18.50	$30.00	$33.00	$31.00
February	13.91	17.85	19.41	25.85	18.16	16.75	19.00	15.50	14.00	17.31	14.00	13.00	18.50	31.25	33.00	31.00
March	14.05	17.80	19.35	26.10	17.85	16.50	18.30	15.50	14.00	17.25	14.25	12.95	18.70	35.40	33.00	29.94
April	14.35	17.60	19.10	26.35	17.73	16.50	17.50	15.00	14.00	17.06	14.25	13.00	19.00	39.25	33.00	26.75
May	13.85	17.60	18.90	26.85	17.63	16.50	17.06	15.00	14.50	16.15	14.06	13.00	19.00	43.80	33.00	26.75
June	13.70	17.00	18.54	26.60	17.73	16.50	16.75	15.00	14.50	15.63	13.69	13.00	19.00	50.37	33.00	26.75
July	13.60	16.47	18.60	25.55	17.55	17.00	16.56	14.87	14.70	14.70	13.75	13.00	19.00	55.00	33.00	26.75
August	13.60	16.60	19.45	24.85	17.35	17.13	16.50	14.50	15.37	15.00	13.69	13.44	18.40	55.00	33.00	26.75
September	13.85	16.60	20.16	24.10	17.05	18.70	16.40	14.50	16.00	15.00	13.31	13.90	18.13	54.50	33.00	26.75
October	14.10	17.66	21.48	22.45	16.85	19.00	16.00	14.46	17.00	15.00	12.94	14.63	19.63	33.00	34.00	27.75
November	15.98	19.15	24.70	20.66	17.10	19.00	16.00	14.09	17.75	14.88	12.56	17.13	25.80	33.00	34.00	31.00
December	16.95	19.60	25.85	18.80	17.35	19.00	16.00	14.00	18.00	14.50	12.90	18.10	29.50	33.00	34.00	29.00

The Cincinnati prices given above date back to the earliest period for which Southern pig-iron quotations are available at that point. It may be said that these quotations represent almost the beginning of the Northern business in pig iron coming from the vicinity of Birmingham, Ala.

The Chicago prices also represent quotations from the beginning of the production of pig iron in the vicinity of Chicago for the merchant trade. For a long time these prices were quoted delivered on track near Chicago foundries, but beginning in 1908 prices were figured at the furnace, from which at that time a switching charge to local foundries of about 35 cents per ton applied. At the present time the switching charge averages about 50 cents.

Mahoning and Shenango Foundry Iron Prices

In the following table are presented the monthly average prices of No. 2 foundry pig iron at Valley furnace, namely, at furnaces in the Mahoning Valley, Ohio, and the Shenango Valley, Pennsylvania, from 1902 to 1919, inclusive, averaged from weekly quotations in THE IRON AGE in dollars per ton of 2240 lb.

	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919
January	$15.60	$22.30	$13.00	$16.12	$17.31	$24.60	$16.80	$15.44	$17.00	$13.75	$13.00	$17.50	$12.85	$13.00	$18.50	$31.00	$33.00	$31.00
February	16.20	21.95	12.47	16.00	17.25	24.12	16.00	15.06	16.60	13.75	13.00	17.00	13.19	13.00	18.31	32.00	33.00	31.00
March	17.76	22.00	12.91	16.00	17.12	24.00	15.56	14.50	16.10	13.75	13.12	16.69	13.25	13.00	18.50	34.75	33.00	29.94
April	19.30	20.99	13.01	16.00	16.50	24.00	15.15	14.00	15.62	13.75	13.25	15.35	13.25	12.75	18.50	39.75	33.00	26.75
May	19.92	20.32	12.47	15.55	16.30	25.00	14.87	14.19	15.31	13.75	13.25	14.62	13.00	12.94	18.20	42.40	33.00	26.75
June	20.60	19.37	11.96	14.81	16.19	25.12	15.00	14.90	14.75	13.56	13.25	14.06	13.00	12.69	18.13	50.25	33.00	26.75
July	21.10	18.02	11.67	14.25	16.44	22.80	14.80	15.19	14.31	13.50	13.37	13.87	13.00	12.70	18.25	54.50	33.00	26.75
August	22.35	16.34	11.87	14.15	17.71	22.50	14.50	15.31	14.15	13.50	13.69	14.00	13.00	13.62	18.25	53.20	33.00	26.75
September	22.30	14.98	11.71	14.56	19.56	20.87	14.47	15.75	13.75	13.44	14.44	14.00	13.00	14.70	18.39	47.00	33.00	26.75
October	22.17	14.09	12.50	15.50	21.35	19.80	14.36	17.12	13.94	13.37	16.10	13.84	12.90	14.87	20.00	33.00	34.00	26.75
November	23.25	13.32	14.60	16.83	23.87	19.00	15.25	17.25	13.90	13.20	16.94	13.50	12.75	15.50	25.00	33.00	34.00	31.50
December	21.25	13.22	16.19	17.35	24.00	17.37	15.50	17.00	13.75	13.00	17.25	13.50	12.75	18.30	30.75	33.00	34.00	36.75

L. S. Charcoal Pig-Iron Prices for 28 Years

The following table, which has been compiled from quotations in THE IRON AGE, gives the average monthly prices of Lake Superior charcoal pig iron per gross ton, in carload lots, at Chicago, from 1892 to 1919:

	1892	1893	1894	1895	1896	1897	1898	1899	1900	1901	1902	1903	1904	1905
January	$17.25	$16.50	$15.50	$13.00	$14.50	$13.50	$12.50	$11.50	$25.50	$19.00	$19.25	$25.60	$16.62	$18.50
February	17.00	16.50	15.40	13.00	14.00	13.50	11.50	12.50	25.50	17.50	20.25	26.50	15.87	18.50
March	17.00	16.50	15.25	13.00	13.50	13.50	11.50	15.75	25.50	17.50	20.65	26.50	15.00	18.50
April	16.75	16.50	15.25	12.75	13.50	13.50	11.50	17.00	25.50	18.00	21.50	25.30	15.19	18.50
May	16.50	16.50	15.25	13.00	13.50	13.00	11.50	17.25	24.50	17.50	22.80	24.12	15.00	17.75
June	16.50	16.00	15.25	13.00	13.50	13.00	11.50	19.50	23.00	17.00	23.50	24.00	14.70	17.00
July	16.50	16.00	15.00	13.50	13.50	13.00	11.50	21.50	22.00	17.00	25.00	22.20	14.50	16.50
August	16.50	16.00	14.50	13.50	13.50	13.00	11.50	22.50	20.00	17.00	25.75	20.62	14.87	16.40
September	16.50	16.00	14.25	14.50	13.50	12.50	11.50	24.25	18.50	17.00	26.00	19.00	14.75	16.87
October	16.75	16.00	14.00	15.50	13.50	12.50	11.50	25.00	18.00	17.00	26.00	18.10	15.31	18.25
November	16.50	15.75	13.50	15.50	13.50	12.50	11.50	25.50	17.00	17.50	26.00	17.12	16.37	19.20
December	16.50	15.50	13.00	16.00	13.50	12.50	11.50	25.50	18.25	18.00	25.25	16.50	17.80	20.00

	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919
January	$20.40	$26.80	$22.50	$19.50	$19.50	$17.87	$16.00	$18.15	$15.25	$15.75	$19.50	$31.75	$37.50	$38.85
February	20.13	27.00	21.38	19.50	19.50	17.50	15.95	18.00	15.25	15.75	19.75	33.75	37.50	38.85
March	19.75	26.75	21.25	19.50	19.30	17.50	15.75	18.00	15.25	15.75	19.75	36.75	37.50	38.85
April	19.44	26.50	20.30	19.50	19.00	17.50	15.75	18.00	15.45	15.75	19.75	40.25	37.50	38.85
May	19.05	27.40	20.00	19.50	18.62	17.25	15.75	18.00	15.75	15.75	19.75	48.15	37.50	38.85
June	19.00	27.50	20.00	19.50	18.50	16.80	16.75	16.81	15.75	15.75	19.75	52.38	37.62	38.85
July	19.06	27.00	20.00	19.50	18.50	16.50	16.25	15.65	15.75	15.75	19.75	57.75	38.00	31.75
August	19.35	27.20	19.50	19.50	18.50	16.50	16.25	14.69	15.75	16.00	19.75	58.00	38.00	32.25
September	20.13	27.00	19.50	19.50	18.40	16.50	17.12	15.25	15.75	15.85	19.75	58.00	38.00	32.75
October	21.50	26.20	19.50	19.50	18.12	16.50	18.65	15.25	15.75	15.75	20.25	57.50	38.00	33.44
November	24.63	25.12	19.50	19.50	18.00	16.50	18.65	15.25	15.75	17.00	26.46	47.50	38.70	38.50
December	26.13	24.25	19.50	19.50	18.00	16.37	18.75	15.25	15.75	18.65	31.75	37.50	38.70	42.00

Billet Prices at Pittsburgh for 32 Years.

The table below gives the average monthly prices of 4 x 4 in. Bessemer steel billets at Pittsburgh from 1888 to 1919, inclusive. The prices are per gross ton and are averaged from weekly quotations in THE IRON AGE. Prior to 1886 steel billets were not a regular merchant commodity.

	1888	1889	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899	1900	1901	1902	1903
January	$29.38	$28.15	$36.65	$25.60	$25.00	$21.56	$16.12	$14.90	$16.80	$15.42	$14.93	$16.63	$34.50	$19.75	$27.50	$29.60
February	29.38	27.81	35.25	26.00	24.36	21.62	15.75	14.95	17.38	15.25	15.06	18.00	34.87	20.31	29.37	29.87
March	29.13	27.25	31.88	26.25	23.00	22.60	15.55	14.84	17.09	15.44	15.25	24.30	33.00	22.88	31.25	30.62
April	28.63	27.00	28.38	25.35	22.81	22.44	15.09	15.44	19.53	14.60	15.06	25.37	32.00	24.00	31.50	30.25
May	28.35	26.90	27.55	25.50	22.41	21.69	18.00	16.30	19.50	13.82	14.85	26.75	28.90	24.00	32.27	30.37
June	28.06	26.75	30.25	25.25	22.97	21.70	18.12	18.63	19.12	14.06	14.65	30.10	27.25	24.38	32.35	28.87
July	28.00	27.13	30.70	25.50	23.50	21.06	18.00	20.75	18.85	14.00	14.50	33.12	21.00	24.00	31.76	27.60
August	28.40	28.20	30.38	25.31	23.81	20.45	17.15	21.75	18.75	14.00	15.85	35.40	18.20	24.20	31.02	27.60
September	29.00	29.50	30.13	25.00	23.65	19.31	17.19	24.00	19.75	15.60	16.00	38.37	16.93	24.88	29.50	27.00
October	29.25	33.70	28.70	24.90	23.53	18.06	16.00	21.90	19.75	16.44	15.56	38.75	16.50	26.70	29.70	27.00
November	29.00	34.00	27.39	24.16	24.94	17.37	15.57	19.13	20.00	15.57	15.06	36.50	18.93	27.00	28.50	24.00
December	28.44	35.60	26.25	24.20	22.40	16.69	15.12	16.97	17.50	15.00	15.80	33.75	19.75	27.50	29.10	23.00

	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919
January	$23.00	$22.75	$26.25	$29.40	$28.00	$25.00	$27.50	$23.00	$20.00	$28.30	$20.13	$19.25	$32.00	$63.00	$47.50	$43.50
February	23.00	23.50	26.50	29.50	28.00	25.00	27.50	23.00	20.00	28.50	21.00	19.50	33.50	65.00	47.50	43.50
March	23.00	24.00	26.70	29.00	28.00	23.00	27.50	23.00	19.75	28.50	21.00	19.70	42.40	66.25	47.50	42.25
April	23.00	24.00	27.00	30.12	28.00	23.00	26.75	23.00	20.00	28.50	20.80	20.00	45.00	73.75	47.50	38.50
May	23.00	23.50	26.40	30.30	28.00	23.00	26.12	22.60	20.80	27.60	20.00	20.00	45.00	86.00	47.50	38.50
June	23.00	22.00	26.63	29.62	25.75	23.00	25.30	21.00	20.87	26.50	19.50	20.50	43.50	98.75	47.50	38.50
July	23.00	22.00	27.25	30.00	25.00	23.50	25.00	21.00	21.50	26.60	19.00	21.38	41.00	100.00	47.50	38.50
August	23.00	24.00	27.80	29.25	25.00	24.13	24.62	21.00	22.13	26.00	20.25	23.13	44.20	86.00	47.50	38.50
September	22.00	25.00	28.00	29.37	25.00	25.00	24.40	20.75	23.62	24.87	21.00	24.10	45.00	66.25	47.50	38.50
October	19.50	25.62	28.00	29.20	25.00	26.25	23.75	20.00	26.00	23.30	20.00	24.63	46.25	49.38	47.50	38.50
November	20.25	26.00	28.83	29.00	25.00	27.12	23.30	19.50	27.00	21.00	19.25	26.50	52.00	47.50	47.50	39.87
December	21.20	26.00	29.50	28.00	25.00	27.50	23.00	19.25	27.00	20.00	19.00	30.25	57.50	47.50	48.50	46.00

Prices of Galvanized Sheets from 1899 to 1919

The table below gives the monthly average prices, f.o.b. Pittsburgh, in cents per pound, of galvanized sheets, as quoted in THE IRON AGE from the beginning of 1899 down to the present month:

Average Prices of No. 28 Galvanized Sheets, at Pittsburgh, in Cents per Pound

	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919
Jan.	3.08	3.83	4.36	4.64	3.70	3.36	3.35	3.45	3.67	3.59	3.55	3.50	3.20	2.90	3.46	2.87	2.79	4.75	6.25	6.25	6.05
Feb.	3.62	4.09	4.36	4.36	3.70	3.25	3.40	3.45	3.75	3.55	3.51	3.50	3.20	2.87	3.50	2.95	3.16	4.75	6.38	6.25	6.05
March	4.17	4.32	4.84	4.36	3.78	3.23	3.45	3.43	3.75	3.55	3.26	3.50	3.20	2.80	3.50	2.95	3.40	4.75	6.69	6.25	5.96
April	4.25	4.78	4.84	4.36	3.89	3.23	3.45	3.40	3.75	3.55	3.25	3.50	3.20	2.86	3.50	2.91	3.29	5.00	7.00	6.25	5.70
May	4.25	4.66	4.74	4.36	3.88	3.23	3.45	3.40	3.75	3.55	3.25	3.50	3.20	2.90	3.42	2.80	3.50	4.94	8.20	6.25	5.70
June	4.52	4.59	4.59	4.23	3.81	3.18	3.35	3.55	3.75	3.55	3.25	3.50	3.00	2.90	3.38	2.75	4.28	4.69	9.50	6.25	5.70
July	4.72	4.53	4.48	4.26	3.73	3.14	3.36	3.55	3.75	3.55	3.25	3.39	3.00	3.00	3.33	2.75	4.40	4.38	10.00	6.25	5.70
Aug.	4.85	4.43	4.74	4.18	3.66	3.14	3.22	3.55	3.75	3.55	3.25	3.30	2.99	3.12	3.24	2.85	3.71	4.21	10.00	6.25	5.70
Sept.	4.59	4.33	4.73	3.99	3.66	3.14	3.30	3.55	3.75	3.55	3.28	3.21	2.93	3.21	3.16	2.95	3.56	4.18	9.75	6.25	5.70
Oct.	4.53	4.25	4.55	3.87	3.73	3.14	3.30	3.58	3.75	3.55	3.35	3.20	2.85	3.36	3.08	2.95	3.50	4.41	....	6.25	5.70
Nov.	4.21	4.16	4.84	3.85	3.51	3.23	3.32	3.65	3.75	3.55	3.43	3.20	2.85	3.40	2.98	2.88	3.89	5.18	6.25	6.25	5.70
Dec.	3.88	4.36	4.84	3.78	3.40	3.31	3.35	3.65	3.75	3.55	3.50	3.19	2.89	3.40	2.90	2.78	4.75	6.00	6.25	6.15	5.70

The highest prices realized for galvanized sheets, aside from the war peak in 1917, were obtained in April, 1916, following the spectacular performances of spelter, when prices of that metal soared to an unprecedented height. At that time, No. 28 galvanized sheets sold up to 5.30c. per lb., Pittsburgh, or higher, although the average for the month is placed, in the table, at 5c. It is interesting to know that in 1901, in a period of great activity in the steel trade, No. 28 galvanized sheets were regularly quoted at 5.10c., Pittsburgh, for two weeks, namely, the first half of September.

In making up the above table of prices the compiler has used for January, February and March, 1919, up to March 21, the prices in effect to the latter date, and then used the 5.70c. price in effect all through the year from March 21. Premiums were paid during late November and all of December, but premiums have not been recorded above, as a large percentage of the sheets sold in 1919 were at the prices named in the table.

Metal, Tin-Plate and Sheet Prices for Twenty-one Years

Monthly Averages Computed from the Weekly Market Quotations of "The Iron Age" in the Period of 1899-1919

(With Supplement)

The accompanying supplement shows by plotted lines the fluctuations in prices of the more important metals, tin plate and sheets in the period from 1899 to 1919, inclusive. The prices used for this purpose are the computed monthly averages of the prices of carloads, at New York, for metals and at Pittsburgh for tin plate and No. 28 galvanized and black sheets, given in the metal market reports of THE IRON AGE week by week. The columns of figures alongside the chart give the values. The column nearest the chart gives tin in cents per pound; the middle column, copper and spelter in cents per pound, and the outside column represents lead and sheets in cents per pound and tin plate in dollars per base box. The following tables give the monthly averages on which the chart is based, except for galvanized sheets, the table for which will be found on page 59.

Lake Copper, at New York, in Cents per Pound

	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919
January	14.02	16.21	16.90	11.45	12.13	12.62	15.18	18.78	24.41	13.90	14.56	14.00	12.81	14.50	16.98	14.85	14.02	24.39	29.73	23.50	20.48
February	17.66	16.25	16.97	12.47	12.80	12.34	15.25	17.94	25.10	13.13	13.37	13.78	12.75	14.41	15.55	15.00	15.21	26.85	34.90	23.50	17.86
March	17.55	16.41	17.00	12.12	14.31	12.60	15.25	18.50	23.38	12.85	12.90	13.75	12.58	14.88	15.05	14.79	15.75	27.10	35.85	23.50	15.46½
April	18.56	17.00	17.00	11.97	14.85	13.19	15.18	18.62	24.62	13.09	12.94	13.31	12.41	16.00	15.67	14.75	18.90	28.27	31.67	23.50	15.55
May	18.65	16.80	17.00	12.10	14.75	13.28	15.00	18.70	24.10	12.88	13.21	13.06	12.33	16.30	15.91	14.40	21.00	28.88	31.42	23.50	16.18
June	18.20	16.31	17.00	12.23	14.56	12.74	15.00	18.69	23.94	13.00	13.50	12.88	12.71	17.53	15.42	14.12	22.38	27.82	32.46	23.50	17.95
July	18.37	16.31	16.97	11.94	13.73	12.62	15.03	18.47	21.95	13.00	13.34	12.66	12.78	17.54	14.78	13.70	21.98	25.84	28.78	25.80	22.07
August	18.50	16.55	16.50	11.59	13.35	12.50	16.07	18.65	18.94	13.71	13.56	12.93	12.75	17.73	15.86	12.85	19.33	26.95	27.24	26.00	23.16
September	18.47	16.75	16.50	11.60	13.58	12.67	16.12	19.31	16.41	13.80	13.50	12.81	12.65	17.77	16.77	12.66	17.97	28.03	24.90	26.00	22.68
October	18.03	16.73	16.71	11.71	13.42	13.09	16.62	21.81	13.80	13.81	13.19	12.84	12.53	17.80	16.85	11.75	17.89	28.48	23.50	26.00	22.13
November	17.00	16.75	16.82	11.44	13.25	14.22	16.90	22.50	13.94	14.44	13.44	12.98	12.80	17.70	16.16	12.00	18.92	32.32	23.50	26.00	20.69
December	16.69	16.87	14.71	11.61	12.30	14.87	18.75	23.06	13.48	14.53	13.80	13.00	13.84	17.69	14.88	13.35	20.24	33.38	23.50	25.40	18.90

Spelter, at New York, in Cents per Pound

January	4.90	4.55	4.08	4.28	4.82	4.95	6.17	6.48	6.90	4.54	5.15	6.26	5.55	6.52	7.15	5.29	6.59	18.19	9.94	7.88	7.38
February	5.68	4.69	3.94	4.18	5.00	4.95	6.12	6.09	7.00	4.78	4.99	5.89	5.56	6.71	6.45	5.40	8.84	20.13	10.48	7.99	6.70
March	5.99	4.60	3.89	4.29	5.36	5.05	6.06	5.96	6.92	4.76	4.81	5.72	5.65	6.98	6.26	5.28	9.29	18.40	10.77	7.64	6.52
April	6.25	4.71	3.94	4.41	5.65	5.22	5.97	6.05	6.81	4.68	4.94	5.60	5.51	6.86	5.77	5.18	11.22	18.58	9.85	7.01	6.51
May	6.72	4.52	3.97	4.50	5.75	5.14	5.55	5.95	6.51	4.60	5.13	5.20	5.50	6.86	5.47	5.06	16.14	15.86	9.46	7.32	6.46
June	6.02	4.27	3.95	4.88	6.00	4.79	5.32	6.14	6.45	4.56	5.39	5.19	5.63	6.99	5.18	5.09	22.18	12.75	9.62	8.01	6.93
July	5.79	4.24	3.90	5.23	5.95	4.85	5.38	5.98	6.15	4.46	5.35	5.20	5.79	7.26	5.38	5.02	20.58	9.83	8.93	8.69	7.90
August	5.55	4.17	3.92	5.46	5.94	4.85	5.66	6.06	5.71	4.71	5.74	5.26	6.04	7.19	5.75	5.60	14.11	8.98	8.69	8.96	7.84
September	5.40	4.10	4.02	5.45	6.00	5.06	5.83	6.19	5.28	4.76	5.85	5.53	6.03	7.53	5.82	5.50	14.16	8.22	8.34	9.60	7.57
October	5.37	4.10	4.20	5.48	6.05	5.17	6.05	6.18	5.45	4.81	6.09	5.69	6.20	7.57	5.42	4.97	13.96	9.98	8.24	9.11	7.83
November	4.64	4.20	4.32	5.29	5.68	5.49	6.17	6.36	5.10	5.03	6.32	5.95	6.60	7.48	5.29	5.12	17.15	11.90	7.95	8.70	8.14
December	4.68	4.19	4.35	4.91	5.15	5.80	6.50	6.62	4.39	5.17	6.35	5.80	6.44	7.33	5.18	5.71	16.69	11.13	7.84	8.45	8.59

Lead, at New York, in Cents per Pound

January	4.02	4.70	4.37	4.02	4.10	4.39	4.56	5.86	6.30	3.73	4.19	4.70	4.50	4.41	4.35	4.11	3.74	5.93	7.69	6.87	5.56
February	4.53	4.70	4.37	4.10	4.10	4.40	4.50	5.56	6.31	3.75	4.07	4.63	4.46	4.00	4.35	4.06	3.82	6.23	9.13	7.04	5.05
March	4.37	4.70	4.37	4.10	4.44	4.50	4.45	5.35	6.31	3.88	4.02	4.51	4.41	4.08	4.35	3.97	4.04	7.43	9.47	7.24	5.23
April	4.30	4.70	4.37	4.10	4.59	4.50	4.50	5.39	6.16	4.02	4.19	4.40	4.44	4.20	4.40	3.82	4.20	7.73	9.43	6.95	5.03
May	4.42	4.22	4.37	4.10	4.37	4.48	4.50	5.90	6.02	4.26	4.32	4.37	4.40	4.20	4.37	3.90	4.25	7.45	11.00	6.88	5.05
June	4.45	3.90	4.37	4.10	4.25	4.22	4.51	5.94	5.75	4.45	4.36	4.38	4.46	4.50	4.35	3.90	5.89	6.87	11.68	7.55	5.33½
July	4.55	4.03	4.37	4.10	4.12	4.17	4.56	5.80	5.24	4.50	4.35	4.40	4.50	4.67	4.37	3.90	5.59	6.34	10.72	8.04	5.66
August	4.56	4.26	4.37	4.10	4.12	4.15	4.64	5.78	5.12	4.59	4.36	4.40	4.50	4.54	4.64	3.87	4.68	6.26	10.72	8.05	5.77
September	4.60	4.36	4.37	4.10	4.26	4.20	4.85	5.92	4.84	4.54	4.39	4.40	4.49	5.04	4.73	3.86	4.62	6.88	8.84	8.05	6.12
October	4.59	4.37	4.37	4.10	4.40	4.20	5.07	5.94	4.64	4.34	4.39	4.40	4.31	5.06	4.52	3.52	4.60	7.00	6.77	8.05	6.45
November	4.58	4.37	4.37	4.10	4.25	4.51	5.48	5.97	4.45	4.39	4.40	4.44	4.31	4.66	4.33	3.62	5.16	7.13	6.44	8.05	6.76
December	4.65	4.37	4.19	4.10	4.19	4.60	5.96	6.19	3.76	4.24	4.56	4.50	4.45	4.32	4.06	3.80	5.33	7.60	6.48	6.71	7.03

Tin, at New York, in Cents per Pound

January	22.12	26.00	26.60	23.38	27.76	28.75	29.18	36.36	42.14	27.43	28.19	32.61	41.20	44.58	50.34	39.12	34.13	41.76	44.10	85.13	71.50
February	24.25	29.71	26.55	24.73	29.14	27.98	29.49	36.48	42.16	28.74	28.44	32.65	43.34	43.56	48.71	39.82	37.25	42.60	51.47	85.00	72.45
March	23.86	32.42	25.95	26.16	30.06	26.19	29.21	36.62	41.29	30.46	28.75	32.51	41.10	42.76	46.93	38.03	48.73	50.53	58.38	85.00	72.50
April	24.82	30.85	25.94	27.29	29.69	27.99	30.43	38.86	40.84	31.79	29.35	32.83	42.05	43.64	49.04	36.10	47.64	51.51	55.82	88.53	72.50
May	25.61	29.25	26.82	29.26	39.26	27.76	30.04	43.08	43.01	29.84	29.07	33.05	43.32	45.98	49.06	33.21	38.79	49.14	63.21	100.00	72.50
June	25.69	30.00	28.22	29.29	28.30	26.14	30.36	38.97	42.65	28.18	29.26	32.79	46.25	47.44	45.01	30.60	40.26	42.07	61.93	91.00	71.83
July	28.72	32.76	27.41	28.28	27.60	26.28	31.71	37.18	41.15	28.62	29.05	32.99	43.23	44.70	41.32	35.65	37.38	38.25	62.61	93.00	70.11
August	31.40	31.13	26.90	28.14	28.00	26.74	32.85	39.90	37.35	29.09	29.96	33.92	43.38	45.86	41.63	48.34	34.37	38.88	62.53	91.33	62.20
September	32.40	29.63	25.04	26.55	27.06	27.27	32.21	40.32	37.22	28.91	30.00	35.17	39.69	49.16	42.63	31.13	33.13	38.65	61.54	80.40	59.79
October	31.35	28.46	24.62	25.76	25.83	28.53	32.47	42.10	32.23	29.44	30.41	36.76	41.23	50.07	40.38	30.25	33.05	41.10	62.24	78.82	54.82
November	28.52	28.10	27.47	25.43	25.25	29.00	33.46	42.70	30.81	30.43	30.74	37.38	43.08	49.87	39.75	33.28	39.50	44.12	74.18	73.67	54.17
December	25.19	26.84	24.39	25.33	27.53	29.27	35.84	42.62	27.92	29.13	32.91	38.21	45.03	49.86	37.12	34.01	38.53	42.66	84.74	71.51	53.80

Tin Plate, at Pittsburgh, in Dollars per Box

January	3.00	4.65	4.00	4.00	3.60	3.56	3.55	3.47	3.90	3.74	3.70	3.60	3.60	3.40	3.60	3.32	3.10	3.75	7.00	7.75	7.35
February	3.38	4.65	4.00	4.00	3.60	3.45	3.55	3.50	3.90	3.70	3.70	3.60	3.67	3.35	3.60	3.29	3.10	3.96	7.38	7.75	7.35
March	3.75	4.65	4.00	4.00	3.80	3.45	3.55	3.50	3.90	3.70	3.53	3.60	3.70	3.30	3.60	3.30	3.25	4.19	8.00	7.75	7.26
April	3.87	4.65	4.00	4.00	3.80	3.45	3.55	3.57	3.90	3.70	3.40	3.60	3.70	3.30	3.60	3.30	3.25	4.50	8.00	7.75	7.00
May	3.87	4.65	4.00	4.00	3.80	3.45	3.55	3.66	3.90	3.70	3.40	3.60	3.70	3.33	3.60	3.30	3.15	5.30	8.40	7.75	7.00
June	3.87	4.65	4.00	4.00	3.80	3.45	3.55	3.75	3.90	3.70	3.40	3.60	3.70	3.40	3.60	3.30	3.11	5.81	10.50	7.75	7.00
July	4.12	4.65	4.00	4.00	3.80	3.41	3.55	3.75	3.90	3.70	3.40	3.60	3.70	3.43	3.60	3.27	3.10	6.00	12.00	7.75	7.00
August	4.23	4.65	4.00	4.00	3.80	3.50	3.55	3.75	3.90	3.70	3.40	3.60	3.70	3.50	3.51	3.41	3.10	5.95	11.40	7.75	7.00
September	4.65	4.50	4.00	4.00	3.80	3.50	3.55	3.75	3.90	3.70	3.40	3.60	3.67	3.58	3.50	3.35	3.15	5.75	12.00	7.75	7.00
October	4.65	4.00	4.00	4.00	3.80	3.30	3.34	3.75	3.90	3.70	3.50	3.60	3.52	3.60	3.50	3.24	3.15	5.81	....	7.75	7.00
November	4.65	4.00	4.00	3.60	3.65	3.39	3.34	3.90	3.90	3.70	3.56	3.60	3.40	3.60	3.40	3.15	3.28	5.97	7.75	7.75	7.00
December	4.65	4.00	4.00	3.60	3.60	3.47	3.40	3.90	3.90	3.70	3.60	3.60	3.40	3.60	3.40	3.13	3.52	6.63	7.75	7.55	7.00

No. 28 Black Sheets, at Pittsburgh, in Cents per Pound

January	1.92½	2.97½	2.90	3.07½	2.75	2.29	2.30	2.40	2.60	2.52	2.50	2.40	2.20	1.90	2.31	1.87	1.80	2.60	4.50	5.00	4.70
February	2.05	3.03	2.93½	3.10	2.75	2.27½	2.30	2.40	2.60	2.50	2.50	2.40	2.20	1.87	2.35	1.95	1.80	2.60	4.69	5.00	4.70
March	2.36	3.10	3.22½	3.10	2.75	2.27	2.34	2.38	2.60	2.50	2.25	2.40	2.20	1.80	2.35	1.95	1.80	2.71	4.94	5.00	4.61
April	2.60	3.20	3.35	3.12½	2.75	2.25	2.40	2.35	2.60	2.50	2.20	2.40	2.20	1.86	2.35	1.91	1.80	2.85	5.75	5.00	4.35
May	2.78¾	3.20	3.30	3.10	2.75	2.20	2.40	2.35	2.60	2.50	2.20	2.40	2.20	1.90	2.30	1.85	1.79	2.89	7.00	5.00	4.35
June	2.93	3.05	3.30	3.05	2.75	2.16	2.30	2.50	2.60	2.50	2.20	2.40	2.00	1.90	2.27	1.81	1.75	2.90	7.88	5.00	4.35
July	2.97½	3.14¾	3.10	3.00	2.73¾	2.10	2.26	2.50	2.60	2.50	2.20	2.23¾	2.00	1.95	2.25	1.80	1.75	2.90	8.50	5.00	4.35
August	3.08	2.98	3.41	3.05	2.70	2.10	2.26	2.50	2.60	2.50	2.20	2.21	1.99	2.02	2.21	1.86	1.85	2.90	8.59	5.00	4.35
September	3.22½	2.93¾	3.77½	2.97½	2.65	2.10	2.25	2.50	2.60	2.50	2.26	2.15	1.91	2.07	2.14	1.95	1.90	2.93	8.50	5.00	4.35
October	3.15	2.90	3.23	2.79	2.62	2.10	2.25	2.50	2.60	2.50	2.30	2.20	1.85	2.21	2.04	1.94	2.03	3.23	....	5.05	4.35
November	3.00	2.89	3.10	2.75	2.49	2.12½	2.27	2.60	2.60	2.50	2.30	2.20	1.85	2.25	1.97	1.87	2.25	3.65	5.00	5.00	4.35
December	2.87½	2.96	3.10	2.75	2.32	2.22	2.30	2.60	2.60	2.50	2.40	2.19	1.83¾	2.25	1.89	1.82	2.50	4.31	5.00	4.85	4.35

The Year in Iron and Steel Metallurgy

Advances for the Most Part Made by Individual Plants — New Developments in Electro-Metallurgy and Progress in Duplexing

BY LEWIS B. LINDEMUTH*

TO the steel industry 1919 has been a year of practically unprecedented conditions. For a period previous to the war the increase in steel making capacity of the country was below the average proportional increase of preceding years. Therefore, under the stress of war orders and forced production, the steel making capacity of the country was increased in a way that under less urgent circumstances might have been different; that is, a number of small plants were hastily erected, both open hearth and electric, in order to meet the demands which existing works were unable to take care of. These small plants in many cases were erected only for the production of special materials and existing plants diverted their product for war purposes.

Quantity production, with little regard to cost, was the natural outcome of war-time conditions and necessarily there followed a higher price for raw materials, a higher conversion cost, and a different relation between the cost of materials entering into the manufacture of steel.

The entire year of 1919 has been devoted to preparation and discussion of terms of peace, methods of financing European countries and combatting labor unrest, with the result that no stabilization of the industry has been possible.

The beginning of the past year, therefore, found the country with a steel producing capacity above normal and in many cases of a nature which could not readily be converted; a rapidly decreasing demand for steel products, and a new level of prices on raw materials. In many plants the latter condition made necessary a change in practice for the purpose of eliminating as much as possible those raw materials whose prices remained proportionately higher than in prewar times.

Advances in iron and steel metallurgy, therefore, were for the most part advances in individual plants over their previous practice, representing to the industry as a whole a higher plane, but not contributing to our knowledge new lines of thought or new applications of principles.

Blast Furnace

The tendency in blast furnace design for the past few years has been gradually toward steeper bosh angles and wider hearths. Greater tonnages and better operations through this design have been realized. The steepest angle so far used, of which we have record, is 82 deg. 10 min. The principal difficulty encountered in some instances with the wider hearths appears to be that it is difficult to bring a furnace back to temperature if for any reason the hearth gets cold. When this is overcome it is quite probable that future developments will be toward a still further increase in the bosh angle until a straight bosh and perhaps a straight shaft furnace is obtained.

Open Hearth

There has been only one metallurgical development in the open-hearth process which might be considered new. This is the use as fuel of tar and coke oven gas combined. It had previously been the practice in many plants where both coke oven gas and tar were available, to use in a furnace either one or the other. The extraction of benzol from coke oven gas, however, reduced to such an extent the illuminating power of the gas that it was found necessary to enrich it in hydrocarbons by the use of coal tar. This combination of fuels proved to be more satisfactory than the use of coke oven gas containing benzol or the use of tar alone. Coke oven gas has a high calorific value, but even before the extraction of benzol it contains a low percentage of illuminants. Heat transmitted to the steel bath is dependent upon radiation. The addition of tar produces a combination high in calorific value and radiating power, and results in a heavy gas which is more easily deflected downward over the bath.

A combination water-cooled gas and tar burner has been designed, therefore, and where so used the coke oven gas with a proportion of tar is distributed to all furnaces. If there should arise a shortage of coke oven gas the gas is distributed to all the furnaces and the shortage made up on each furnace by an increase in the quantity of tar.

Duplex Process

The use of the duplex process has steadily increased. Duplex plants, consisting of acid-Bessemer converters and large tilting open-hearth furnaces in the neighborhood of 200 tons capacity, are now in operation at the Lackawanna Steel Co., Steelton, Saucon and Maryland plants of the Bethlehem Steel Co., South Chicago plant of the Illinois Steel Co. and Gary plant of the Indiana Steel Co. The Tennessee Coal, Iron & Railroad Co. at Ensley, Ala., duplexes with 100-ton tilting open-hearth furnaces. The Donora plant of the American Steel & Wire Co. duplexes with 60-ton stationary basic furnaces. The Lackawanna Steel Co., Saucon and Steelton plants of the Bethlehem Steel Co., and the Illinois Steel Co. can also carry out the duplex process in stationary furnaces. The Maryland plant of the Bethlehem Steel Co. previous to this year conducted its duplex process with 50-ton tilting open-hearth furnaces.

The duplex process is economical with plants having sufficient blast furnace capacity and with iron costs low enough that the 5 per cent differential in ingot yield in favor of the straight open-hearth process is offset by the cost of pig and scrap mixtures, by the lower unit production, the higher plant investment and higher fuel and conversion cost of the straight open-hearth process. In the past year the labor situation in several plants has made the duplex process essential for the maintenance of production. The product per man of the duplex process is more than double that of the straight open-hearth process.

The quality of product from the duplex process can be made equal to the best steel of the straight open-hearth process through the use of manganiferous materials or other deoxidizing elements. There are some special conditions which make duplexing imperative, but with the many factors upon which its commercial success is dependent its future development upon a large scale is problematical.

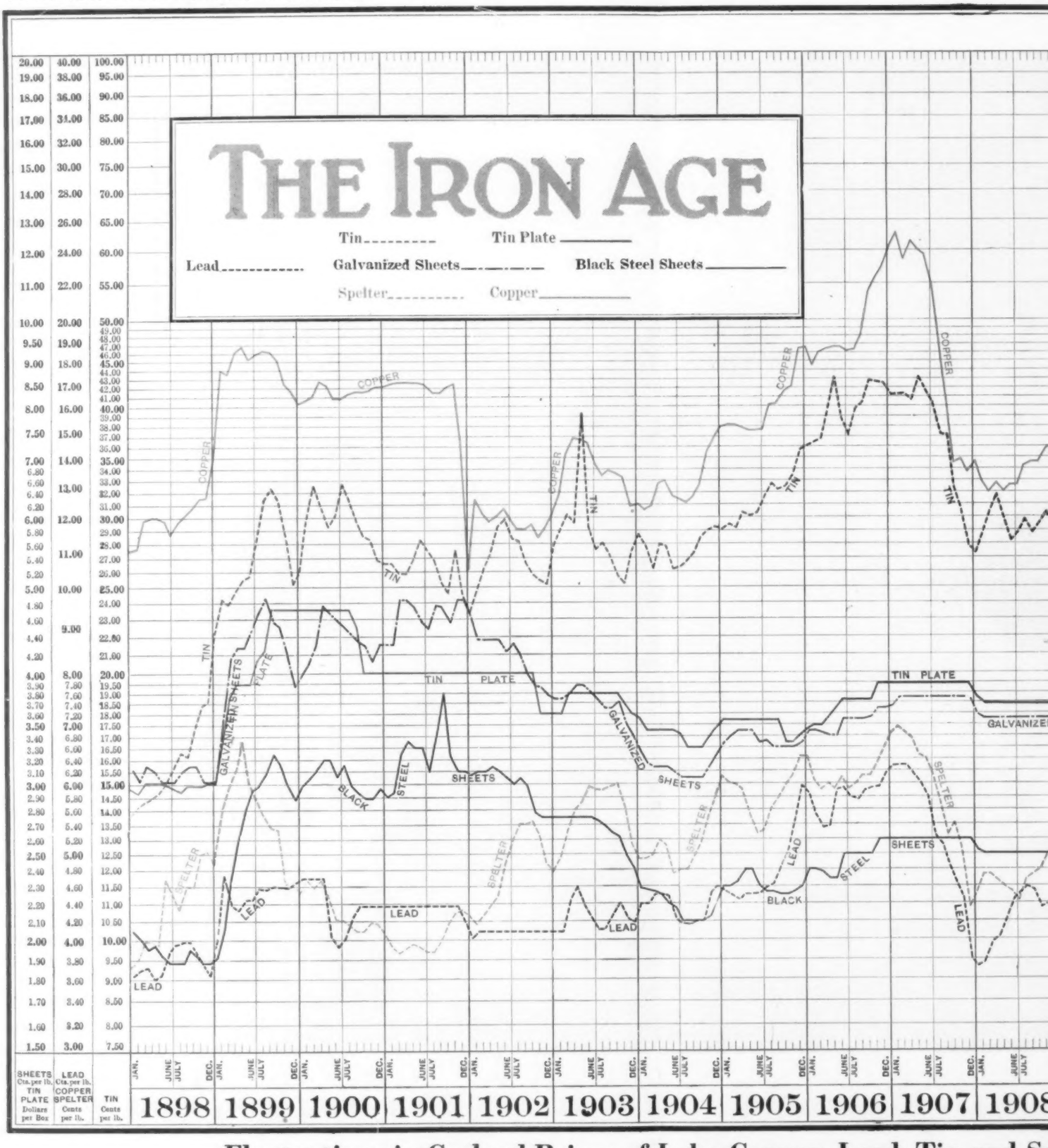
Acid Open Hearth

During the war there was a marked increase in the production of acid open-hearth steel. This was due to the fact that the acid process, as generally conducted, produced steel of a quality more suitable for gun forgings than the basic. This, however, does not represent a permanent tendency in the steel industry of this country.

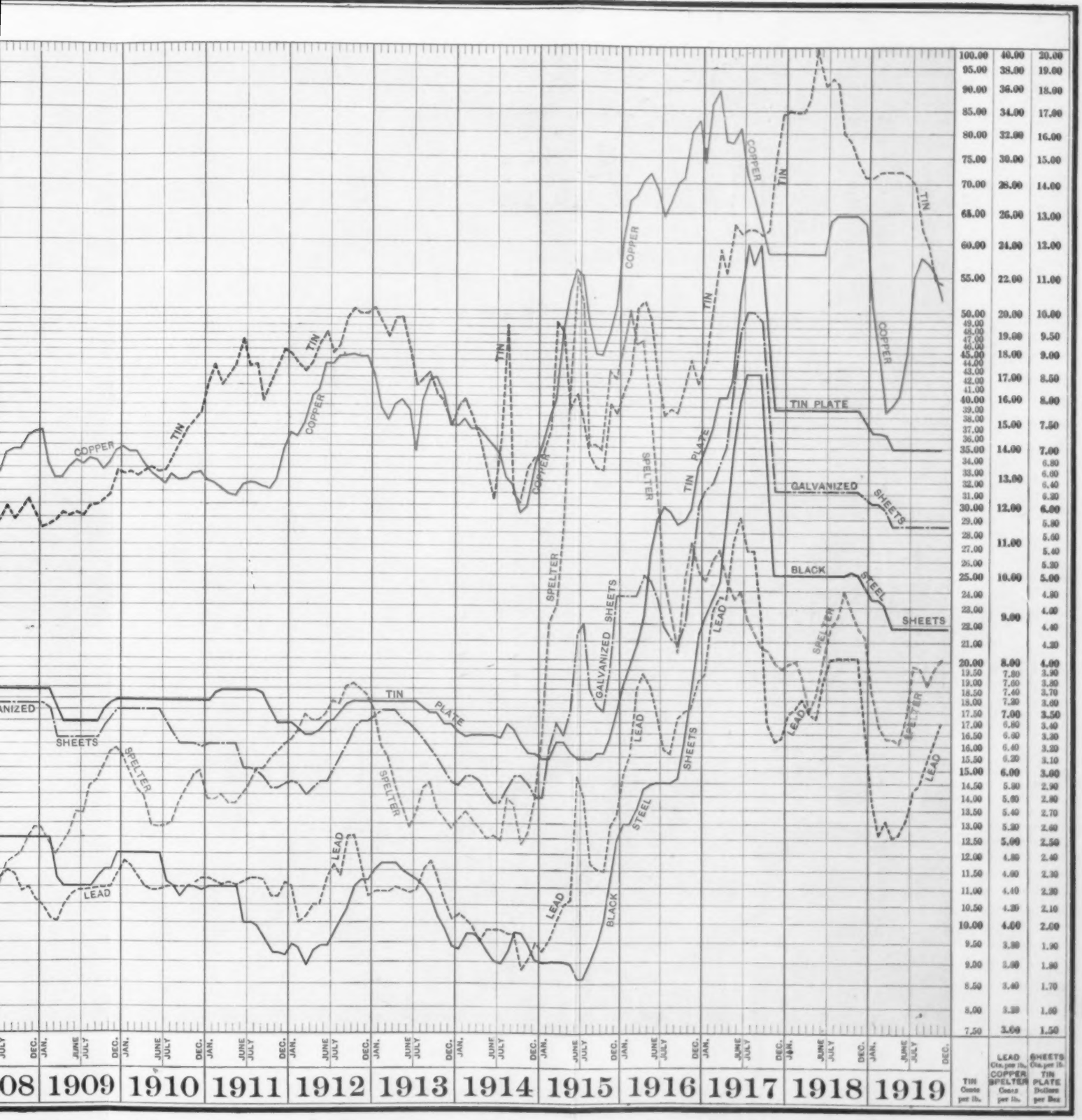
Electric Furnace

There has been a continued increase in the number of electric furnace installations. Not so much from

*Carney & Lindemuth, New York.



Fluctuations in Carload Prices of Lake Copper, Lead, Tin and Sp
Sheets in Pittsburgh from Janua


COPPER
TIN
LEAD
SPELTER
TIN PLATE
GALVANIZED SHEETS
BLACK STEEL SHEETS
100.00 40.00 20.00
95.00 38.00 19.00
90.00 36.00 18.00
85.00 34.00 17.00
80.00 32.00 16.00
75.00 30.00 15.00
70.00 28.00 14.00
65.00 26.00 13.00
60.00 24.00 12.00
55.00 22.00 11.00
50.00 20.00 10.00
45.00 18.00 9.00
40.00 16.00 8.00
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08 1909 1910 1911 1912 1913 1914 1915 1916 1917 1918 1919
TIN Cents per lb.
LEAD Cts. per lb. COPPER SPELTER Cents per lb.
SHEETS Cts. per lb. TIN PLATE Dollars per Box

Spelter in New York and Tin Plate and No. 28 Black and Galvanized
nuary 1, 1898, to January 1, 1920

the fact that high quality which can be produced in electric furnaces was desirable, but because of the fact that under many local conditions of raw material markets, demands and power costs, the electric furnace can compete commercially in the production of small castings, with converters, and in other cases as a substitute for the crucible process. Properly operated electric furnaces can produce steel of a quality equal to crucible steel, and with the decreased demand for all grades of crucible steel during the past year the electric furnace is largely replacing the older and more expensive process. The demand for higher quality is continually increasing so that the electric furnace as a producer of steel for automobile manufacturers and other high-grade consumers in many cases has supplemented the open hearth.

In design of electric furnaces there was a recent tendency on the part of some manufacturers both in the United States and England to increase the transformer capacity. This tendency has been given up in England, but in this country apparently there is still a question as to its advisability.

Future developments of electric furnaces for the large part of their production will probably be with furnaces of large capacities for duplexing either from the open hearth or Bessemer. Furnaces of 35 tons capacity have been designed for this purpose.

In Lorraine and Belgium, where pig iron contains from 1.50 to 1.75 per cent phosphorus and high sulphur, the process before the war was the basic Bessemer, which produced a steel of questionable quality. French and Belgian metallurgists in considering the rebuilding of destroyed plants have estimated that they can produce simple steel commercially by duplexing from the basic Bessemer to basic electric furnaces of large capacity. As the ores of this district contain a high percentage of sulphur which can be reduced in the electric furnace the quality of product from these ores will be greatly increased.

Testing

A very interesting but not yet practical development has been the examination of metals by X-ray. It has been possible with very high-powered rays to see defects in steel of small sections. In the present use of the method, however, it is only possible to see these defects if they are known to exist and it is not yet applicable to the finding of internal defects.

Electro-Metallurgy

There has been developed in France and Switzerland a process for the electro-deposition of iron in the form of bars and boiler tubes. The process is accomplished by the use of a ferrous chloride electrolyte, a rotating cathode, and a special depolarizing agent. The current density employed is very high, being about 1000 amperes per square meter. The process employs scrap iron or steel of any analysis. One ton of finished tubes requires an electric consumption of ½ h.p. per year. One plant used scrap of the following analysis:

Carbon	2.35 per cent
Silicon	1.31 per cent
Phosphorus	1.07 per cent
Sulphur	0.07 per cent

and obtained tubes with a composition of:

Carbon	0.004 per cent
Silicon	0.007 per cent
Phosphorus	0.008 per cent
Sulphur	0.006 per cent

This material after a special annealing to eliminate hydrogen shows:

Tensile strength	45,000 lb. per sq. in.
Elongation	40 per cent

The tubes as they come from the mandrils are brittle, containing approximately 0.45 per cent hydrogen. A special annealing process removes the hydrogen and gives a most pure and ductile product.

This process has been patented in practically all countries. Licenses have been granted under these patents to representatives in the United States, most European countries and to several countries in Asia.

Rolling Mill

Labor conditions have stimulated the already growing tendency in rolling mill design toward larger units, specialty mills and automatic handling. All mills of the past few years have been designed to eliminate labor down to the minimum. Instead of the installation of "utility" mills for rolling varied lines of product, several mills of a specialty nature are recommended by rolling mill manufacturers for the most economical operation. Practically all mills of recent installation and those in course of construction are so designed that roll changes are made by changing housings.

General

The developments just enumerated are for the most part continuations of previously existing tendencies accelerated by the unusual industrial conditions. These same conditions have forced manufacturers, particularly the smaller steel producers, to employ previously devised but not commonly employed metallurgical features for the economics involved. Greater unit production, higher yields from furnaces and ingots, and better quality products have been essential to the continued existence of many plants. Improvements in open-hearth furnace design with respect to ports, checker chambers, etc., mold design to reduce internal defects and increase the yield, proper producer practice for the nature of coal available, use of hot tops on ingots, control of pouring temperatures, and many metallurgical details depending upon local conditions have been worked out in plants which had previously paid little or no attention to the possibilities of such improvement.

Conclusion

The year 1919 has brought out little that is new in the metallurgy of iron and steel, but the more general application of metallurgical principles necessitated by economy has raised the standard of iron and steel production in the country as a whole.

Heavy Melting Steel Scrap Prices, Pittsburgh

The appended table gives the average monthly prices of heavy melting steel scrap at Pittsburgh for 18 years, comprising 1902 to 1919, inclusive. These prices are in dollars per gross ton and are averaged from weekly quotations in the Pittsburgh iron market report of THE IRON AGE.

	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919
January	$17.40	$21.20	$12.50	$16.25	$17.25	$18.95	$12.80	$16.63	$17.69	$13.50	$12.75	$14.95	$13.62	$11.63	$17.50	$22.60	$30.00	$19.00
February	17.63	21.13	13.50	15.88	16.31	18.06	13.88	15.63	17.25	14.13	12.12	14.19	12.62	11.63	17.06	21.75	30.00	14.75
March	18.50	21.00	14.00	15.90	14.70	18.00	13.19	14.19	16.80	14.35	12.62	14.19	12.12	12.00	18.45	23.25	30.00	14.00
April	19.00	21.50	13.63	16.00	14.75	17.94	12.80	14.00	16.50	13.06	13.06	14.19	12.00	11.81	17.81	28.00	28.50	15.20
May	20.00	21.25	12.13	15.00	14.80	18.10	12.81	14.81	15.30	12.62	13.95	13.55	12.00	11.75	16.95	28.80	28 50	14.75
June	21.25	20.00	11.30	13.90	15.63	18.38	13.13	15.69	15.10	12.95	13.44	12.62	12.00	11.75	15.88	41.00	28 62	17.12
July	21.90	19.70	10.75	14.00	15.75	18.06	14.25	15.90	14.80	12.06	13.34	12.40	12.00	12.31	16.31	39.00	29.00	19.70
August	21 00	18.50	11.38	14.85	16.50	17.75	14.81	16.31	14.31	13.20	13.55	12.37	11.50	13.81	16.05	32.83	29.00	21.00
September	21.50	17.25	11.50	15.88	16.88	17.38	14.25	17.40	14.35	12.50	14.11	12.25	11.31	14.30	16.19	33.25	29.00	19.20
October	21.50	15.70	12.25	16.50	17.13	17.10	15.20	17.94	14.25	12.06	15.85	11.85	10.85	14.38	18.25	28.80	29.00	19.00
November	21.00	13.25	14.25	17.50	18.00	14.88	16.06	17.50	14.25	12.00	15.12	11.44	10.00	15.88	21.20	29.50	28.87	22.75
December	21.00	11.20	16.20	17.63	20.00	13.00	16.70	18.00	13.75	12.31	14.75	11.08	10.75	17.45	26.00	30.00	26.87	24.25

British Iron and Steel in 1919

Decreasing Production, Unsatisfied Demand, Record Profits and Still Advancing Prices —Not Likely to Regain Old Export Position

LONDON, ENGLAND, Dec. 12.—A retrospect of the British pig iron trade for the year 1919 must of necessity be a somewhat gloomy record, for the difficulties which confronted the manufacturers during the period of the war have been accentuated since the conclusion of the armistice, and the result is reflected in a further decline in the output for the year. From January to December the demand has been continuously in excess of the supply, and after fulfilling urgent home requirements there has been but little available for shipment abroad. Thus the hopes that in the first year following the termination of hostilities Cleveland might be able to pick up the lost threads of its export trade in pig iron have been largely unrealized, and when the year's returns are completed, it will be found that the export trade was of even smaller dimensions than in any of the four years of war. The fact is, of course, that production has been steadily diminishing. Unable to get either the ironstone or coke in adequate quantities, the Cleveland ironmasters have gradually been compelled to reduce the number of furnaces in blast, and the latest figures indicate that only 63 are in operation against 71 at the beginning of the year.

There have moreover been various interruptions in the working of the furnaces, which have further tended to reduce both the volume and the quality of the output. In July, for example, the blast furnace operatives insisted upon a holiday to participate in the peace celebrations. No offer of extra pay would content them. The men were determined that they, too, should enjoy the benefits of a respite from their labors, and it was consequently arranged to take the blast off the furnaces from the Saturday until Tuesday. That meant a direct loss in production and irregularities when the furnaces resumed working again.

Less Furnaces in Blast Than at Year's Beginning

The stoppage involved through the great railroad strike later in the year was far more disastrous in its consequences to the pig iron trade. When the strike signal was given there were many furnaces with scarcely sufficient coke to damp down. It was a position of the greatest gravity, and every ton of coke had in some cases to be put into the furnaces to meet the emergency. A few—but very few—Cleveland blast furnaces managed to keep going but the majority were idle for the full period of the strike, and apart from the loss of production, the ironmasters suffered heavy financial loss. Thus the relative number of furnaces in blast does not represent the full extent of the decline in output for the year, and it is probable that the Cleveland production will not exceed 2,750,000 tons. In the last pre-war year, 1913, Cleveland's output was 3,869,000 tons, and as there are now 117 furnaces in existence, of which only 63 are in operation, it will be seen that there is ample room for a big expansion of output as soon as circumstances permit such a development.

The great obstacle is undoubtedly the disappointing outputs of the coal and ironstone mines. It is needless here to dwell upon the facts of the coal shortage. They have received full publicity. Suffice it to say that in common with every other industry the iron trade has felt the pinch. Many iron producing firms own also their collieries and coke ovens, so that to some extent they were in a stronger position than the ordinary consumer, but all have suffered more or less, and will continue to do so until the coal output reaches a more satisfactory level. The case of the Cleveland ironstone mines has not come so boldly into the limelight, but here also the output has been most disappointing. In fact this has certainly been due to the lack of cars, which has caused many interruptions at the mines, but the introduction of the 7-hr. day in the Cleveland mines has been a much more serious factor in the reduction of output.

Lacking adequate supplies of both fuel and ore, the Cleveland ironmasters have had no alternative but to reduce output, and as this has had to be effected in face of a heavy demand for supplies it is scarcely a matter for surprise that throughout the year there have been complaints of a shortage.

Results of Government Controlled Rail Rates.

These complaints, however, have been seriously accentuated (1) by the disproportionate amount of forge iron produced by the furnaces, and (2) by the inadequacy of the facilities for distribution. The causes of the abnormal output of low grade iron have already been dealt with. The effect has been that while no difficulty has been experienced in getting forge iron, the standard qualities have been exceptionally scarce, and wherever possible consumers have had to mix the two qualities in order to eke out the meagre supply of foundry iron.

Thus there has been a heavy increase in the pressure upon the railroads, but so long as the government deliberately preserves railroad freights at an uneconomical figure, they can scarcely wonder at traders taking advantage of the position. They have now given notice of an early prospective rise in railroad freights so as to place them on an economic basis, and when this is effected no doubt increasing use will be made of coastwise traffic, with corresponding relief to the railroads.

Reduced Speculation in Pig Iron.

One other effect of the prospective rise in railroad rates will be to increase the selling prices of pig iron. There have been few changes during the year. Gone are the days when the operations of the Glasgow warrant ring were able to cause daily fluctuations in the price of Cleveland pig iron. The stocks of iron in the public store, amounting at times to over half a million tons, have disappeared, warrants have been withdrawn from circulation and there are now no counters for the speculators to gamble with. A period of stabilized prices has ensued, and though experience of the new state of affairs is comparatively brief, it has been sufficient to convince every one of the real advantage to the trade which has been the result of the changed conditions. Forward buying has become possible on a solid basis, and the confidence which has been imparted is all to the good of the trade.

Ample notice had been given but it was not until April 30 that the state subsidy on pig iron and the official control of prices ceased. Up to that point No. 3 Cleveland g. m. b. was sold at 95s. per ton to home consumers and 145s. per ton for export. With the withdrawal of the official maximum price list, makers commenced to do business at 140s. per ton, but the scarcity of supplies was such that buyers entered into keen rivalry, outbidding one another in the scramble for supplies, so that in less than three weeks 160s. per ton had been reached with every prospect of further advances.

Iron Masters Checked Uptrend in Prices

Then the iron masters came to a somewhat surprising decision. It was felt that this upward trend of prices was not in the best interests of the trade. The temporary advantage of high prices was only gained at the expense of an ultimate diminution in the demand, and acting as they thought in the best interests

of the trade, the Cleveland iron masters agreed by common consent to re-impose a series of maximum prices, 160s. per ton being the limit for the standard No. 3 quality to home consumers and 165s. per ton to buyers abroad. That figure has ruled ever since, although toward the end of November the makers agreed that the premium for No. 1 quality, which had up to that point been fixed at 4s. per ton, should thereafter be 7s. 6d.

In July, when the extra 6s. per ton was added to the price of coal, it was fully anticipated that there would be a rise in pig iron prices. As a matter of fact it was calculated that the 6s. on coal involved an extra 12s. per ton in the cost of producing Cleveland pig iron, and in every other area prices were advanced proportionately. Not so in Cleveland. The May advance having left them with a fair margin of profit, the iron masters decided to shoulder the burden of coal costs instead of passing them on to the consumer, and no change was made in selling prices.

Advances to Follow Higher Freight Rates

But what may be termed the limit of endurance has now been reached, and notice has been given to the trade that immediately the higher railroad rates become operative the price of Cleveland pig iron will be advanced upon the following basis: For every 1 per cent advance in railroad rates 1¼d. per ton will be added to the price of Cleveland pig iron, and ½d. per ton to the price of East Coast hematite pig iron.

The average quoted price for the year works out at 137s. 10.63d. per ton for home consumption and 157s. 7.66d. per ton for export, while the average ascertained selling price of No. 3 Cleveland g. m b. for the first three quarters of the year have been as follows: Quarter ended March 11, 118s. 11.75d. per ton; quarter ended June 30, 141s. 11.74d. per ton; quarter ended Sept. 30, 158s. 4.98d. per ton.

Falling Off in Exports

A fairly accurate estimate can now be made of the total exports for the year, and placing these at 250,000 tons, the following table comparing the official returns for former years reveals the extent of the decline in pig iron exports from the Tees:

Pig Iron Exports from the Tees

Year	Coastwise Tons	Foreign Tons	Total Tons
1919	34,600	215,400	250,000
1918	73,191	337,726	410,917
1917	21,438	503,992	525,430
1916	18,167	609,373	627,540
1915	45,525	383,202	428,727
1914	426,390	500,206	926,596
1913	509,042	737,842	1,246,884
1912	502,776	837,316	1,340,092
1911	525,409	798,857	1,324,266
1910	482,708	716,680	1,999,388
1909	449,297	742,561	1,191,858

The falling off has been entirely in the exports to France and Italy. In 1918, 70 per cent of the total exports went to France, this year the percentage is likely to be less than 20 per cent. Italy has imported over 40,000 tons, but would certainly have taken more but for the high freights, and the urgent necessity for her to curtail imports until the exchange is restored. On the other hand, Belgium has come into the market as a big consumer of Cleveland iron. She has been much our best customer, taking nearly 60,000 tons, and most of the European neutrals also now offer a ready market for Cleveland iron as it becomes available for shipment. One curious feature has been the shipment of over 7,000 tons from the Tees to the United States. This has all been special iron, but the fact that so much should be shipped across the Atlantic, at a period when America was actually competing with us in European markets, affords a curious illustration of the interdependence of trade.

In connection with the export trade a notable event of 1919 has been the withdrawal of the system of export licenses. It was not until Nov. 21 that a notice was gazetted announcing the abolition of this last vestige of control, and even now licenses are necessary for the export of scrap iron. The freedom of the export trade in pig iron is, however, a welcome event, and in happier circumstances of supply will do much to encourage the resumption of the export trade.

Labor and Wages

Turning to labor questions it is gratifying to find that although extraneous industrial troubles, such as the bricklayers' strike, the metal working strike, the coal strike, the railroad strike, and the molders' strike, have all had their effect upon the pig iron trade, the domestic differences, as between the Cleveland ironmasters and their employees, have all been amicably adjusted without the loss of a single day's work.

Wages both in the mines and at the furnaces are regulated by a sliding scale based upon the realized selling price of No. 3 Cleveland g. m. b., but all these advances, so far as the miners were concerned, were merged in the Sankey award which became operative in January, 1919. Under this the miners got an advance of 2s. per day, and their wages now stand at 105 per cent above the standard plus 5s. per day war wage. Under the sliding scale the blast furnace men have experienced the following fluctuations in wages:

Changes in Blast Furnacemen's Wages

Jan. 7. Reduction from 108½ per cent to 108 per cent above the standard.
April 7. Advance from 108 per cent to 115 per cent above the standard.
July 6. Advance from 115 per cent to 137¼ per cent above the standard.
Oct. 5. Advance from 137¼ per cent to 158 per cent above the standard.

In addition to the sliding scale adjustments, the blast furnace men have negotiated a revision of the base rates which have been increased by 54 to 105 per cent in the case of the various grades, thus representing an advance of 10s. to 15s. per week for the different classes of workmen.

The immediate outlook may not be very encouraging, as output is still curtailed by the lack of raw materials, but there is a heavy demand for iron both at home and abroad. The world's need is in truth likely to be greater than the supply for many years to come.

Year's Profits the Largest Ever

It is difficult to review the course of the trade in British finished iron and steel during the year now closing, without a feeling of considerable apprehension as to the future of this great British industry. That the profits of the trade have been enormous, and far in excess of those in any other period may be admitted, but it is to be feared that the penalty of this large prosperity has yet to be paid, and paid in full. As we write there is no sign of any apprehension that all is not right with the industry, and few people appear to realize the dangers which lie ahead, but the fact of unconsciousness does not render these dangers any the less real.

When business in iron and steel opened this year the whole position was under the influence of the Defence of the Realm Act, and of the rather absurd system of subsidies which had come into operation by reason of that act, and it was not until April that business was freed from the domination of "Dora." Hence up to the beginning of April the prices current in the trade bore no relation whatever to the actual costs of producing iron and steel, the whole nation being taxed in order that the Government might seem to be obtaining its supplies at moderate rates. When the subsidies were abolished at the beginning of April, there was of course a startling jump in all the prices, but this proved only to be the beginning of the advance which was to take place.

During the whole of the time since April various forces have combined to raise the prices of finished iron and steel, but none of them, nor the combination of the whole of them, is sufficient to justify many of the figures now current in the trade. To account for some of these latter day prices one has to take into consideration the element of scarcity, which is a more potent factor in the raising of prices than either costs of raw material or the wages bill.

One of the main reasons for the steady rise in the selling values of finished iron and steel here has been the failure of supplies from America. At the beginning of the year it was confidently expected that so soon as shipping became more abundant the competition of American iron and steel works would be felt, and severely felt, in every department of the trade, and that British manufacturers would be compelled to keep their prices within reasonable limits. This expectation was disappointed partly by the labor troubles in the United States, partly by the continuance of extravagant freights, and partly by the steady and continuous fall in the exchange, so that in the end British makers of iron and steel found that they had practically a "protected" market, and a demand far exceeding their capacity for production.

The gradually increasing cost of fuel and labor furnished the excuse for steady increases in all iron and steel prices, but these are regarded as much greater than is at all necessary for the securing of ample profits, and in some departments of the industry the profits are now greater than they have ever been in the most prosperous times. The price of common bar-iron, for instance, was put up to £20 per ton when the subsidies were taken off, and at that time the cost of the raw materials, viz., forge pig iron and heavy wrought scrap iron, were much as they now are, but increases have gradually been added from time to time until the present price has reached £23, and in actual practice consumers generally find that they have to pay £24 for bar iron and £27 for hoop iron. The profits on this manufacture may be guessed when it is said that good heavy wrought scrap is being supplied now to bar iron makers at £7 15s. per ton, so that there is a margin of £15 per ton for the conversion of wrought scrap into merchant bars. At one time £3 10s. to £4 per ton would have been an ample margin for the manufacturer.

Steel Prices Lagged Behind Iron

The prices of finished steel have always lagged a little behind the finished iron prices right through the year, but they are still considered sufficiently extravagant, and will leave a good opening for import trade with America so soon as this again becomes practicable.

The year 1919 opened with the selling rates about as follows: Ship plates, £14 per ton; boiler plates, £15; bar steel, £14 5s.; angles and sections, £13 12s. 6d., and rails, £13 7s. 6d. When the subsidies were taken off in April, ship plates were put up to £17 10s.; boiler plates to £19 10s.; angles to £17, and bars to £17 12s. 6d., although the public had been told that the subsidies were only about £2 10s. per ton. Since then there have been several increases, said to be owing to increased costs, and we have now arrived at the following official prices: Ship plates, £21; boiler plates, £24; angles, large, £18 5s.; bar steel, £19 10s. for flats and £21 5s. for rounds; rails, £16 10s., but in actual practice buyers have to pay premiums on these prices ranging from £1 to £3 per ton. One of the most extraordinary advances in prices is to be found in the nut and bolt trade, where the quotation for iron nuts and bolts has risen to £45 per ton for the ordinary sizes. This ought now to attract the attention of American makers for there seems room here to afford the high freights and the effect of the low exchange, and yet leave a big margin of profit to the importer.

British Former Export Position Probably Lost

Before the war the export trade in finished iron and steel was really the back-bone of the British industry, and one could scarcely imagine that the manufacturers here could get along without it, but this section of the trade has been steadily losing its importance, and is still on the down-grade. It seems probable that export business will never again return to its old position so far as the British manufacture of iron and steel is concerned, for whereas we used to grumble here about the competition of Germany in this branch we stand now in far greater danger of the more effective competition of America. If the American manufacturer chooses he can probably have the pick of the world's trade in finished iron and steel during the next few years. To show what has taken place it is only necessary to compare a few figures taken from the returns of 1914 and 1919 for these are eloquent on the subject of the decline of British foreign trade as a result of the war. In the year 1914 we exported 500,614 tons of railroad rails, and in the ten expired months of 1919 for which we have returns the exports of this particular form of steel reaches only 97,752 tons. The figures for wrought iron, i.e., bars, rods, etc., were in 1914 137,305 tons and in 1919 (10 months) they are 29,304 tons. Cast iron manufactures were 81,458 tons against 17,237 tons. Tin plates were 494,921, against 236,513 tons, and galvanized sheets, 762,244 tons, against 131,340 tons, and so on through the whole list, although where the export is calculated in values, as it often is, the great falling off is not so clearly seen.

The public here, and possibly elsewhere, is deceived by the practice of stating exports in value instead of in quantity, and is under the pleasing delusion that the export trade of the country is very much better than it really is. It is to be feared that the British manufacturer, glutted as he is with extravagant profits, is blind to the fact that he has lost the greater part of the foreign trade, and that when he wants it again he will not find the process of recovering it quite so easy as the process of losing it.

France Losing Opportunities

On the Continent of Europe conditions are still chaotic, and the time when trade will begin to move along again in its old channels seems to be indefinitely remote. The French so far show little aptitude for handling, on a business basis, the Alsace-Lorraine works which have come into their possession, and in fact have already gone a long way toward antagonizing all foreign buyers by the autocratic and non-commercial policy adopted. When sellers refuse to conform to any specification and cancel contracts at their own sweet will, buyers are frightened away.

The French works generally are hard hit by the fuel shortage and the railroad chaos, and there are no present signs of any betterment in these respects. In Belgium the people have now buckled down to work, but the destruction wrought by the Hun has been so systematic and wholesale that a year or so must elapse before Belgian iron and steel output cuts any figure in the country's economics. Germany is all at sea and a wholesale shuffling of the cards has been, and is still, in progress arising from the loss of Alsace-Lorraine. All over the continent of Europe demands for iron and steel products are enormously beyond the capacity of supply, and a prolonged period of excessively high prices is certain.

The following shows certain of the losses to Germany under the peace treaty, the output being of course in tons:

	In Silesia		In Alsace-Lorraine		In Saar District	
	No. of Wks.	Ann. Output	No. of Wks.	Ann. Output	No. of Wks.	Ann. Output
Iron mines	10	137,469	54	21,136,265	..	.....
Lead, silver and zinc mines	12	1,341,713	..	.....	..	.....
Sulphur	8	288	..	.....	..	.....
Pig iron works	8	994,601	13	3,863,524	5	1,371,389
Iron foundries	42	99,742	40	94,808	16	98,242
Steel works	11	1,396,287	7	2,289,250	7	2,079,856
Rolling mills	13	1,415,436	8	1,554,001	8	1,056,702
Lead, silver and copper refineries, etc.	3	93,522	..	.....	..	.....
Spelter refineries, etc.	18	176,446	..	.....	..	.....

Another export business suggestion involving the shipment of parts for assembling at the point of consumption is made by Ercole Viscardini, 71 Corso Sempione, Milan, Italy. He points out that American typewriting machines, for example, are prohibitively high with the present rate of exchange, with the result that buyers are waiting for the reopening of normal commercial trade with Germany in the hope that German makes, owing to a favorable exchange, will cost very much less. He feels that one way to prevent German competition would be to send different parts of the machine in sets for economizing in freight and on customs.

Striking Features of Lake Superior Mining

An Unsatisfactory Year, but Not Without Progressive Steps — Released Corporation Properties No Longer on the Market — Mesaba's Fine Showing — Cuyuna's Misfortunes

BY DWIGHT E. WOODBRIDGE*

SO unsatisfactory a year in iron ore has not occurred for a long time. Strikes of one sort or another in all branches of the industry, varying from insignificant ones at mines—insignificant because the situations were well handled—to the terribly serious coal strike, so miserably dealt with, checked operations, increased costs and otherwise bore hard on the mining business. There was a scant supply of men, and that supply did not deliver good work; costs were rapidly mounting. Weather conditions on the Lakes and in the Northwest were bad, fall shipments were cut off by severe cold and shipping suffered. Final cargoes were loaded with the utmost difficulty.

Total water shipments from the Lake Superior region were 47,177,395 tons, a decrease of 14,850,000 from the year before and 17,200,000 from 1917. In the final summing up, all rail shipments will also show a decline, though perhaps not so marked as in the case of the Lakes. The Steel Corporation shows a little greater proportion of the total than for the year before, on account of its policy early this season of pushing forward everything it could, but it does not vary much from the percentages of the past four or five seasons.

	Total Shipment	Total U. S. Steel	Percent. U. S. Steel
1915	47,272,751	21,318,320	47.63
1916	66,658,466	30,255,616	47.52
1917	64,437,003	28,655,771	44.34
1918	62,036,082	25,801,503	41.66
1919*	47,177,395	21,591,412	45.75

*Water only.

One of the significant facts of the year is this, that the Mesaba has increased its per cent of the whole; the range which can respond most easily to a demand is also called on in a dull year for a greater share than in the past. This, of course, is a matter of relative costs. That it means an early depletion of the range and the production of more of its lean ores is also true. The Mesaba percentage of the whole is as follows, together with the Steel Corporation's Mesaba percentage of its total shipments:

Year	Lake Superior Mesaba Pct. of Total	U. S. Steel's Pct. from Mesaba
1915	62.95	80
1916	63.80	82
1917	64.32	83
1918	64.29	83
1919	64.70	84

Preparations for Next Season

Poor as the year has been, preparations for next season continue at about the usual pace; most operators, aside from the Cuyuna district, are busy at their underground properties and are extending their open pits. Chief of these latter operations include work of extending the pit of Wakefield, on the Gogebic, opening Bourne, Scranton and some others, near Hibbing, and several new operations by the Oliver Iron Mining Co. Wages are very high, from an average of about $5.50 day work to nearly $1 more on contract operations. Miners are not hard to get, and there is at present no indication of any approaching labor difficulty, although I. W. W. activities in other parts of northern Minnesota make operators fear these pests will again attempt to make trouble in the mining districts. Their last efforts were so unsuccessful, however, that they may not try again soon.

Mines went into the winter with considerable ore unshipped, especially of the lower grades; still stockpiling is proceeding as usual, and there will be as much ore on surface next spring as formerly. As yet there has been no discussion of ore price for the new year. Some operators point to the recent advances in pig iron as proof that a higher ore price is proper, but these advances have not yet put the price of iron higher than it was when the ore rates for 1919 were established.

Former Corporation Properties Disposed Of

IT is now five years since the Steel Corporation relinquished its lease of the Great Northern Iron Ore Properties, after having held them eight years and mined therefrom 26,500,000 tons under constantly increasing royalties and minimums. For the final year of its lease the royalty averaged $1.28 per ton, and was increasing at the rate of 3.4c. per ton per annum. As there was an adjustment between royalties and rail freights, the royalty for 1919 to the Steel Corporation would have been $1.31 and the aggregate minimum 8,250,000 tons. The trustees of the Great Northern have been active in leasing their ore properties, having established a revolutionary change of policy after the death of James J. Hill, dropping out of the operating end altogether. To-day they have under lease for operation very nearly all their ore deposits that are of a grade suitable for mining now, and the wisdom of the change in policy as well as the acumen of the trustees is apparent. While they are not receiving such a royalty as would have been paid by the Steel Corporation, indeed such a price was not to be expected, they have leased at from 80c. to $1 a ton, and the annual production from their mines will soon be about as great as it would have been under the Steel Corporation lease. The final deals have been with the Cleveland Cliffs Iron Co., which has taken properties near Hibbing and elsewhere; before that there were deals with the Hanna Ore Co. and with various independents from time to time. It may be said, therefore, that of the approximately 300,000,000 tons of ore thrown open when the Steel Corporation abrogated its lease, none now presses on the market. I take it that this is one of the matters of moment that have transpired during the year.

*Mining engineer, Duluth, Minn.

Tendency to Open Pits

The tendency grows to develop by open pit methods Mesaba range mines existing under deep cover. During this year a large operating concern took a property near Hibbing that in the past unquestionably would have been opened for underground mining, for it has about 60 feet of ore and an overburden of from 130 to 150 feet. A careful study was made and it was decided by the engineers that there would be a saving of approximately 10c. a ton if open pit methods were adopted; so, in spite of the great initial cost of stripping, a contract was let and work is beginning. This is not a high grade mine, nor is it large. Other examples of the same tendency might be given. On the other hand, there are several Mesaba mines that have seen their last locomotives in the pits, changing to underground on account of the depth to which they have been mined and the impossibility of taking ore out on the steep gradients now required. Shenango is one of these, and the most striking immediate example. Mines are under development in the Mesaba whose cost per ton, under the most favorable present circumstances,

must be practically equal to their selling price. Such an advance in wages as is rumored for the new year will put the balance for these mines distinctly on the wrong side.

Cuyuna Range Has a Very Bad Year

ON the Cuyuna range things have gone from bad to worse; the collapse of the market for its manganiferous ores closed those of its mines producing that ore from underground and reflected seriously on its open pits. Its shipments for the year were reduced from 2,500,000 tons to 1,800,000, and the situation in some of its towns is very bad. The State tax commission has recognized the difficulties under which its mines labor, and has made a radical cut in taxable valuation, and therefore in the amount of money that must be paid by the mines. In many cases present valuations are but one-fifth or one-tenth what they were a year ago. All attempts at washing Cuyuna ores have been melancholy failures, and the Rowe mine washing plant, erected at a cost of more than $250,000, is now offered at $40,000, with no takers, so far as I have heard. The Rowe is an example of ill-advised expenditure that is almost without parallel in the Lake Superior region. What little ore remains in the property is being taken out from a tract removed from that on which the management estimated a deposit of 100,000,000 tons and upon which it built its washery after stripping millions of yards of overburden from what afterward proved to be rock. The ore left in the mine is coming up from underground. Improvement bonds of Cuyuna range villages that will mature long after every ton of ore now known to exist in the taxable area has been removed, have been sold through reputable bonding houses. Communities have been built up, requiring all the machinery of municipal life and necessitating heavy taxes, when there is no probability that these taxes can be forthcoming without working great hardship upon the citizens. Vast sums have been laid out for the opening of mines that, as soon as they were opened, were found unavailable. The responsibility for this situation, except in such cases as at the Rowe, may be laid to the change in the manganese ore situation at the close of the war. In general manganiferous ore producers are high and dry, although such a mine as Manomen has been able to make long time contracts, so lately as last midsummer, by which it sells an ore assaying 36.5 per cent iron and 10 per cent manganese on a 46.5 per cent iron basis, thus receiving twice the iron unit price for the 5 units of manganese. Many of the producers of the range feel that when the manganese supplies are absorbed that were bought by the Government or by others at high prices, there will be a chance for them once more. The Government was a buyer of Cuyuna range manganiferous ores during the war and at prices that ran in the neighborhood of $10 a ton at mines. Most of this ore has now been sold at sharp sacrifices, but it is not yet out of the way. Producers of manganiferous ores, who made claims under the War Minerals Relief Act, have been eliminated by the ruling that they did not produce manganese, merely iron ore containing manganese, despite the fact that this ore was taking the place of manganese, and thus meeting the requirements of the situation. This ruling is regarded as outrageous.

There is now to be another effort to beneficiate ore from that range at Adbar mine at Trommold. This property has been considered an underground proposition, having some 90 feet of overburden, and it is not listed as of taxable value by the State Commission. The commission does not tax as ore any underground washable deposit. But it has been leased by the Breitung interests, from Marquette, which will strip it and have made such tests on the ore as give reason for the belief that it can be beneficiated into a high grade Bessemer product. The tonnage is large and the experiment is being watched with earnest hopes for success. This range has suffered, more perhaps than any other about the Lake aside from the Gogebic in its early days, from the get-rich-schemes of crooked promoters. This was but the natural sequence of its nearness to the Mesaba, and the examples of sudden wealth that the Mesaba furnished.

Demands of Fee Owners

Shipable grades of ore are growing poorer; some fee owning interests, notably the State of Minnesota, are demanding that ores assaying down to 45 per cent dry iron, or say about 40 natural, shall be mined and mixed when the resultant product is not under 48 natural, and also that no ore of any sort shall be wasted by undercutting or caving; this with an eye to the future. While the average of Mesaba ores shipped two years ago was about 51 per cent iron, it is fast coming to 48 with all that grade means to the operator. On the other hand, the trend of royalties is upward all the while; a day or two ago, an old 25 cent lease was up for renewal and was changed to 70 and 85 cents for underground and open pit, respectively. The advance in fixed charges is almost staggering. This is especially true as to taxes, not only on the Mesaba, but all through the region and in all the States. In the village of Hibbing, with an $85,000,000 taxable valuation, the rate for 1920 is 55 mills, so that the village will have as its fund to expend the shamefully large sum of $4,675,000. Did ever in the history of mankind a village of 10,000 people spend so much on itself in a year?

Practically 95 per cent of the money raised in Hibbing by taxation is from the mining companies, the Steel Corporation interest leading, with Mahoning following hard after with a tax charge against its product amounting to $3,000 for every day of the full calendar year. No relief seems in sight, and no effort of the mining companies has been able to check the demands of the communities. It is causing restlessness elsewhere in the States affected, and is adding fuel to the flame of demand for the supertaxation of mines. Steel Corporation taxes in Minnesota paid in 1919 amounted to about 40 cents per ton on the year's product, and the amount will be larger in future.

For the first time there has been a decrease in the total amount of iron ore in Minnesota, as shown by the books of the State; this decrease amounts to 37,000,000 tons and leaves as known ore in the State 1,399,835,000 tons. The taxable value of the ore in the State is reduced by $13,000,000 for the year. This means simply that there has been practically no exploration; no one doubts that exploration might reveal several hundred million tons more merchantable ore, but no one cares to explore.

Various Methods of Beneficiation Expand

THE business of beneficiation continues to expand; new crushing, screening and washing plants are planned, and the great works for the magnetic separation of lean magnetites, experiments on which have been under way for some years, are to be erected at once. The Oliver Iron Mining Co. has completed and put into operation a washery differing from that at Coleraine, which has been the model that all present washing plants have followed, more or less closely. The company has discarded the so-called "turbo," a secondary log washer in which ore is agitated by jets of water from beneath, and that later experiments have found to be practically useless, and its new plant at Eveleth consists of a 35-ft. log, the longest in existence, together with a crushing plant for handling chunks of hard ore and rock too large to be shipped without breaking. The Cleveland Cliffs Iron Co. is to build a large washer, and Hill Annex mine of the Jones & Laughlin Steel Co. will probably soon have one. A crushing and screen plant is under construction at Mead mine, a Tod-Stambaugh enterprise. The preparation of ores at the mine is a more and more popular

industry, and is compelled by the attitude of fee owners and by appreciation of the fact that conservation is advisable.

Washing of Ore

The washing of iron ore to remove free silica has become an important industry since the first washery was built in 1910. Now there are 17 of these plants in the State of Minnesota capable of producing approximately 10,000,000 tons of concentrate in a season. Except for that at Eveleth, they are similar in general design, differing only in detail. All of them are on the unit plan, and each unit will produce from 50 to 200 tons of concentrate per hour, depending on the nature of the ore and the grade of product desired. They cannot improve low grade ore, when by the term low grade is meant material in which iron and gangue are in combination; they are suitable for concentrating what is essentially high grade iron mixed with silica or other free gangue minerals. A plant of standard construction, and consisting of washing trommel, a 25-ft. log, two smaller "turbo" washers, when such are desired, together with tables for retreating the fines, will cost approximately $100,000 and will produce concentrates at a low cost.

A typical washable ore gives a screen analysis about as follows:

Size	Screen Analysis of Crude — Pct. by Weight	Pct. Iron
On 1-in. mesh	7.60	59.50
On ¾-in.	6.70	59.50
On ½-in.	17.0	58.70
On 4 mesh	15.0	59.25
On 8 mesh	10.0	58.80
On 14 mesh	5.7	57.00
On 28 mesh	4.0	55.20
On 48 mesh	3.0	52.50
On 65 mesh	1.0	48.00
On 100 mesh	1.0	41.00
Under 100 mesh	27.0	13.00
Unsized, original	100.0	45.30

As this analysis shows, the whole problem in this method of concentration is to wash away the minus 100 mesh material, for the remainder will give a product of about 58 per cent iron, containing 87 per cent of the iron in the crude. This product, being free from fine silica or alumina gangue, is drier than the crude ore, and is a better furnace material, having lost only that part of its iron which would be likely to be lost as flue dust. Many attempts have been made to wash ores that contain coarse sand, or where the iron itself is lean. Such efforts have failed, for they have produced a low-grade concentrate of doubtful value, or they have had no result at all. There are many deposits in the Lake Superior region where concentration has not yet been attempted, but where it will pay, either on the entire deposit or on parts of it. Doubtless there will be the development of small, temporary, perhaps portable, washing plants for the beneficiation of small deposits or of pockets of wash ore in larger mines. This, I take it, will be one of the early developments of the wash ore idea. A machine for this purpose has just been developed by the Minnesota School of Mines, E. W. Davis, superintendent, which consists essentially of a Dorr classifier and a revolving trommel, the latter set at the lower end of the former. Experimental results of this simple machine have been good, but it has not yet been put into actual operation on a commercial scale.

Companies Making Progress

While the former leaders among independent shippers, such as the firms of M. A. Hanna & Co. and Pickands, Mather & Co., still maintain their prestige, others approach them. Tod-Stambaugh & Co. interests this year, for the first time, passed the 2,000,000 ton mark in shipments, and the Cleveland Cliffs has extended its operations materially; other independent operators are finding it unnecessary to sell through agents; there has been a movement toward the "cost plus" idea in mining, and such mines as Judson and one or two others are now operated on that basis; old mines in the discard for years, like Rolling Mill, have been successfully reopened; eight or ten formerly large shippers have been abandoned as exhausted; exploration for deep-seated ores on the west Gogebic has continued, but in, perhaps, not quite so sanguine a manner as before; more and more the mechanical underground loader is making a place for itself, and the six or eight acknowledged types are all in use at mines about the Lake.

Changes in the Vermillion

Vermillion range was the scene of some kaleidoscopic shifts during the year. Zenith mine, for many years a property of the Oliver company, was leased during the summer to a corporation composed of some of the fee holders and Messrs. Sellwood and Kent, of Duluth, on a 20 per cent sliding scale royalty. This would mean, now, about $1.50 per ton. The former Oliver royalty was 30c a ton, increased somewhat however during the final year of its operation. Among those who are interested in this operation is T. F. Cole, formerly chief executive of the Oliver company. Section 30 mine has rearranged its finances so that it will be able to sink the deep footwall shaft that has long been needed, and which is designed to reach a depth of not less than 1400 feet, in order to negotiate the rich ores that have been cut by the drilling campaign which has been on the past two years. New contracts between the mining company and the fee holding interest have been made, royalties have been reduced and minimums waived for a considerable period, so that the company may carry out its plans without complication. Section 30 company has never been able to go after its deep seated ore, but now it looks as though it might. Instead of controlling the situation on the Vermillion range in its entirety, as formerly, the Oliver company now has but three of the seven active properties there: Zenith and the two Chandlers and Section 30 are independently operated.

Activities of the Republic

The Republic Iron & Steel Co. has taken over Townsite mine, at Ironwood, and is already operating there. This is a mine that Coates & Tweed, of Duluth, have been working the past year or two; it lies in the north lense of the Gogebic formation. All the former Ferd. Schlesinger mines on the Gogebic are now controlled by the Steel & Tube Co. of America, as part of a combination made earlier in the year. They are very large, high grade underground deposits, and give the company ample reserves for a long time. The Oliver company has about completed the project of electrification of its Ironwood group of mines, delayed because of the war. New deep footwall shafts have been sunk and preparations made for many years of large and economical operation. Davis mine, further east on the same range, is also under electrification by the same company. The Castile Mining Co., of Oglebay, Norton & Co., is developing extensively and is one of the coming properties of the Gogebic. At Wakefield mine, of M. A. Hanna & Co., there have been removed since the original discovery of the deposit in 1912, a total of 7,000,000 yards of overburden, of which more than a million yards has been rock. During the same period ore shipments have been almost 5,000,000 tons. This mine and its close neighbor, Plymouth, have been the sensation of the Lake country, containing as they do a vast tonnage of Gogebic range ore so close to surface that it is being mined open pit. They are each good for many years. Wakefield has recently installed an ore drying plant capable of 1600 tons per 24 hours.

Oliver Iron Mining Co. Spending Millions

THE Oliver company is spending several millions of dollars in the purchase of surface rights in Hibbing, in the removal of buildings to the new town of Alice, in the construction of stores, hospitals, etc., there, and in general municipal improvements, though these latter are done directly by the village itself. This is in preparation for the stripping of 40 acres in the present village for mine operations, it being underlain by a

large deposit controlled by the company. Contrary to the general practice among model town builders of the present day, the Oliver company has made no effort toward architectural harmony or advanced municipal engineering in the development of this location. No doubt the difficult local situation at Hibbing has had something to do with this, but it is to be regretted, for there was an opportunity to do splendid and monumental work at no extra expense. A hospital to cost half a million, several stores to cost from one hundred to one hundred and fifty thousand each, a power plant to cost a million and a half, are among the improvements under way there now.

Pittsburgh Base Controversy

When the review was written for the year 1918 something was said as to the plans of the United States Steel Corporation for increase and diversification of steel making at Duluth, also as to the probabilities of a struggle over the doctrine of the Pittsburgh base for steel. Both of these matters have moved along during the past 12 months, until now the situation is considerably clarified. Preliminary hearings over Pittsburgh basing have been held, and it is probably safe to assume that the Federal Trade Commission will order a complaint and that the matter of this single basing point will be thoroughly aired. It is improbable that the case will consume as much time as has been predicted, or that final decision will be very long delayed. It has been assumed that the Steel Corporation has been a bitter opponent of a change in the system, but this may be more doubtful than some think. It is the independent steel makers of the East who are violently opposed to the change. Activities of the Steel Corporation in the matter of additional steel mill construction at Duluth are working out rather rapidly now, and the situation is very encouraging to those who have hoped for a larger tonnage and a wider diversification of mill products there.

Canada's Efforts

Canada is making a determined effort to interest capital in its iron ore resources, but so far has been unable to secure the passage of the mining bounty bill which was pressed last spring before Parliament. So far as is generally known, there are in Canada few deposits of merchantable iron ore; most of the iron material found has been of a nature requiring concentration, usually magnetic. Large quantities of this material exist in parts of Ontario, especially west of Lake Superior. North from Thunder Bay, too, are banded hematites, near enough to be worth while if they can be beneficiated, which seems probable. Early attempts to mine these ores were unsuccessful, but there are likely to be other and more scientific efforts before long. Rumors are heard that high grade ores have been found near Hudson Bay. Some 10 years ago C. K. Leith made a reconnaissance of the region along the east side of the Bay, about parallel 55, north latitude, and discovered an iron bearing formation and the rocks that are kindly for mineral, but it was not supposed that he made any finds of merchantable ore. Most of the iron ore consumed in Canada is imported, either from the States or from Newfoundland. The Michipicoten district has developed into a field almost exclusively for beneficiation of siderites, and shipments from there of direct merchantable ore have almost ceased.

An Important Decision

The Supreme Court of Minnesota recently decided, and has just now affirmed its decision, that in State mineral leases everything that contains iron is ore, and that the State royalty of 25c. a ton must be paid, not on the concentrated product, as has been the case, but on the crude material. The case came up in connection with a new mine in section 9, T 56, R 23, on which a washing plant was erected. The lessees tendered the royalties on concentrates "shipping weights," and the State sued for royalties on the crude ore as mined. In the district court the State lost, but on appeal it won. There may well be doubts of the correctness of this decision from a purely legal standpoint —the leases given by the State define the weights on which royalty shall be paid as "shipping weights," meaning thereby the weights of the railway taking away the ore—but many things can be and are done under the guise of public policy which could not be done under a strict interpretation of law. The decision is of importance to all owners of washable properties, State and private, except where the word concentrate appears in the contract. Adjoining the mine over which the case was brought is Hill Annex, a State property of vast tonnage operated under sublease from the Great Northern Iron Ore Properties by the Jones & Laughlin Steel Co. Much of the ore requires washing, and the foundations for a large plant were constructed some time ago. The lessees pay 25c. to the State and 75c. more to the Great Northern. There are several other properties in a similar situation.

One peculiar fact in this decision of the court is its statement that "beneficiation is no part of mining." This opens many questions and complications.

British Motor Combine for Mass Production

LONDON, Dec. 5.—The American Chamber of Commerce in London reports a £6,000,000 (nominally $30,000,000) combine in the British motor industry, which is the first really big step toward mass production in that country. The new company will be known as Harper, Bean, Ltd., and will include such firms as A. Harper & Sons & Bean, iron founders of Dudley; Vulcan Motor & Engineering Co., Stourport; Swift of Coventry; the British Motor Trading Corporation; Hadfields, Ltd., steel manufacturer, Sheffield; as well as a number of subsidiary manufacturers of electric lighting and starting sets, jigs and tools, radiators and accessories. In this way the amalgamation will control the manufacture of all component parts.

The American Chamber in London understands that the designs have been standardized, and that production will begin immediately at the rate of 50 cars per week in January; increasing to 300 per week in July, 1920; to 600 per week in the following December; rising ultimately to an output of 2,000 per week in 1923. The ultimate production will be split three ways to include 50,000 of the small car, 25,000 of the medium car and 25,000 of the commercial vehicle.

Employees will be given a tangible interest in the results by the setting aside of 500,000 paid up ordinary shares as a benevolent fund for them and their dependents, the income from which will be distributed by a committee of six directors and six employees.

New Forge Shop, Duff Mfg. Co.

The Duff Mfg. Co., North Side, Pittsburgh, manufacturer of lifting jacks of all types, has erected a new forge shop which is now in operation, but all of the tools have not yet been installed. This shop was built for the purpose of supplying the increased demand for Duff jacks, but the company is now in position to accept orders for commercial drop forgings. The shop is equipped for producing forgings, such as automobile and tractor parts, gear blanks, machine parts, wrench forgings, etc. The new building, 80 x 160 ft., is built of brick and steel, and follows the most modern practice. The roof is of the monitor type with a height of 30 ft. under trusses, and an overall height of about 50 ft. The piping for air, fuel and steam is located underground in concrete ducts. When all of the equipment is installed, the forge shop will contain six 2000-lb., three 3000-lb., two 6000-lb., one 1000-lb., and one 400-lb. steam drop hammers, and one 2000-lb., and one 1600-lb. board drop hammers. Thirty-two furnaces will be installed for the heating of billets. An individual motor-driven trimming press will be provided for each hammer, together with an Ajax forging machine, Bradley hammer, and other auxiliary machinery. The new building also includes a heat treating department, with an initial equipment of three annealing and two tempering furnaces. Each furnace is equipped with temperature recording instruments of the most modern type. A chemical laboratory is a feature.

Automotive Industries Greatly Expanded

Demands for Iron, Steel and Machinery From Car and Truck Manufacturers Are Enormous—1,500,000 Tons of Iron and Steel for 1920 Program

THE most remarkable development in metal working lines in the year just ended was the expansion of the automotive industries, and this expansion will extend well into 1920. Since the first of the year the automotive industries, particularly those engaged in making passenger cars, have been constantly in the market for machine-tool equipment, while demands for steel have grown amazingly. During the past few months of steel shortage the automobile manufacturers have been a leading factor in bidding up prices, one Detroit company having offered premiums of $30 to $40 a ton for sheets for making automobile bodies.

Based on an estimated average of 1300 lb. per car, the consumption of iron and steel in the manufacture of passenger cars in 1919 was approximately 1,200,000 tons. *Automotive Industries*, a publication for automobile manufacturers, estimates the 1919 production of cars at 1,750,000, this being exclusive of trucks. The same publication estimates the 1920 production at from 2,000,000 to 2,250,000 passenger cars, though the actual result may be nearer the lower figure because of the steel shortage. On this basis, however, the automobile industry will require in 1920 about 1,300,000 tons of iron and steel for passenger cars, and the additional consumption for trucks and tractors will probably bring the total up to 1,500,000 tons, though the truck and tractor output has not been very definitely estimated. In 1918, a war year, in which there was an exceptional demand for trucks, the production was 227,250, but in all probability the 1919 output was not much over half of this figure.

Passenger Automobile Production in the United States

Year	Number	Wholesale Value
*1899	3,700	$4,750,000
*1904	21,281	23,634,367
*1909	127,731	159,918,506
1910	181,000	213,000,000
1911	199,319	240,770,000
1912	356,000	335,000,000
1913	461,500	399,902,000
*1914	543,679	413,859,379
1915	818,618	565,978,950
1916	1,493,617	797,469,353
†1917	1,740,792	1,053,505,781
†1918	926,388	801,937,925

*From U. S. Census reports.
†Production figures compiled by Automotive Products Section, War Industries Board.

Motor Truck Production in the United States

Year	Number	Wholesale Value
*1904	411	$946,947
*1909	3,255	5,230,023
1903 to 1910	10,374	20,485,500
1911	10,655	22,292,321
1912	22,000	43,000,000
1913	23,500	44,000,000
*1914	25,375	45,098,464
1915	74,000	125,800,000
1916	90,000	157,500,000
†1917	128,157	220,982,668
†1918	227,250	434,168,992

*From U. S. Census reports.
†Production figures compiled by Automotive Products Section, War Industries Board, from sworn statements by manufacturers.

All of the above-mentioned quantities of steel consumed for passenger automobiles are not used directly by the automobile manufacturers themselves, but include the tonnages that go into parts and accessories.

Growth of Automobile Manufacture

The accompanying figures, which illustrate the growth of the automobile industry, are taken from sworn statements of members of the National Automobile Chamber of Commerce, from United States Census Reports and from sworn statements made in 1918 to the War Industries Board:

Expansion in All Districts

While the greatest expansion naturally took place in the center of the industry at Detroit, other districts have not lagged behind. In and about Cleveland and Chicago, the plants have grown in keeping with the general growth of the industry, and there have been unmistakable evidences that the East is regaining something of its former position in motor car manufacture.

The Willys Corporation at Elizabeth, N. J., which will get into production about the middle of 1920, has bought about $1,000,000 worth of machine-tool equipment, and will aim for an output of about 500 cars per day of a light, six-cylinder type. Recent new financing of the Locomobile Co., Bridgeport, Conn., discloses what is virtually a merger of this company with the Mercer Automobile Co., Trenton, N. J., which is expected to make both of these companies more important factors in the industry. The H. H. Franklin Mfg. Co., Syracuse, N. Y., is expanding, while new plants in the East include that of the Rolls-Royce Co. of America, now being established at Springfield, Mass., and the Dupont Motor Corporation, Wilmington, Del. The Stevens-Duryea plant at Chicopee, Mass., will be rehabilitated and enlarged, and it is likely that the Simplex car will be manufactured by the new Wright Aeronautical Corporation, New Brunswick, N. J. The expansion of the plant of the New Departure Mfg. Co., Bristol, Conn., a unit of the General Motors Corporation, has called for the recent expenditure of close to $1,500,000 for new machine-tool and forge shop equipment.

Michigan Plants Greatly Enlarged

EVERY automobile company in Detroit and Michigan planned at the beginning of 1919 to expand its plant facilities anywhere from 33 1/3 to 100 per cent in order to permit an equal increase in production during 1920, or sooner if possible. This because there was an apparent shortage of 2,500,000 cars to meet the demand at the beginning of the year, and it was not believed possible to manufacture more than 1,500,000 during the year, even by rushing production to the utmost. As a matter of fact, it is estimated that motor car production in Detroit and Michigan during 1919 was only approximately 1,100,000, owing to the many setbacks in the form of strikes and delays in settling war contracts.

What progress was made by the various companies in their plant expansion programs for 1919 is problematical, for a variety of reasons. Strikes, with their consequent materials shortages, together with long and sometimes rather disastrous delays in obtaining payment from the Government on war contracts, had a large effect in preventing completion of the programs, or those parts of the programs planned for the year. Lack of steel and lack of coal may be said to have worked the most harm. Slow deliveries of machine tools also was a factor. The amount of building supplies early contracted for by each concern determined to a large extent the progress made on expansion programs. Further expansion plans for this year must await completion of what was planned for 1919, in most cases.

The entire list of automotive plant extensions started in Detroit and Michigan during 1919 is too long to be put down here, but a few of the more important may be mentioned. Of course, the most important that is

under way at present is the huge Wills-Lee development at Marysville, Mich., adjacent to Port Huron, Mich., and the numerous other developments growing out of the original one. Prominent among these is the projected plant of the Huron Steel Corporation, which is to be built directly across the river from Marysville, near Sarnia, Ont.

The most important expansion program from the standpoint of money expended is that of the General Motors Corporation. General Motors announced last spring that it intended spending $26,392,000 in Michigan to extend its plants. Of this amount $12,650,000 was to be spent in Detroit. When completed the new General Motors plants will enable the company to double its 1919 production of nearly 400,000 cars throughout its entire list of subsidiaries.

Among the many companies that hope to double their output in 1920 as a result of plant extensions are the Cadillac, Scripps-Booth, Maxwell-Chalmers, Buick, Chevrolet, Olds Motor Works, Dort, Hudson, Essex, Briscoe, Harley Motors, King, Liberty, Hupp, Paige-Detroit and many others, including numerous small companies throughout the State. The Ford Motor Co. manufactured approximately 800,000 cars in 1919, and intends to manufacture considerably more in 1920. At one period in 1919, just prior to the steel strike, the Ford company was producing nearly 4000 cars a day, but this has been considerably reduced of late owing to shortage of steel and coal.

Approximately 80 per cent of the business of machine tool and supply dealers in Detroit and Michigan is done with the automotive industry. Consequently, the expansion of the automotive industry has caused a similar expansion in the machine tool trade.

Machine tool deliveries have been a serious problem, and still continue to be so. The automotive industry, in spite of unsettled labor conditions, has been placing machine tool orders rapidly and business continues to increase as plant extensions are slowly completed.

The matter of steel consumption in Detroit and Michigan has all along been merely one of obtaining as much material as possible. As the production for 1919 is estimated at about 1,100,000 motor cars of all kinds, it appears that steel consumption in 1919 was far above pre-war levels, but it would have been far higher than it was had it not been for conditions that created a widespread policy of hand-to-mouth buying just prior to the steel strike. What the future will bring depends on the final outcome of the steel strike situation. What the consumption will be if the automotive industry gets the supplies it wants may be judged from the estimate that 1920 production schedules for the entire industry will exceed 2,000,000 passenger cars, possibly reaching 2,250,000.

The General Motors Corporation early in 1919 purchased 38 acres of land near Walkerville, Ont., across the river from Detroit, for the purpose of extending its Canadian facilities. The Republic Truck Co., Alma, Mich., is planning to build a plant in Toronto, Ont.; the Fisher Body Co., Detroit, is to have a plant in Windsor, Ont., and the Maxwell Motor Car Co. has a plant under way at Walkerville, Ont.

New Plants and Additions in or Near Cleveland

IN the Cleveland territory the automobile industry showed a marked growth during 1919, and builders have prepared production schedules for 1920 that will more than double their output of cars during the past year. To provide capacity for the increased output several companies have completed or now have under way large extensions to their plants. During 1919 car builders in Cleveland turned out over 42,000 gasoline passenger cars, and their schedule for 1920 is for an output of 99,000 passenger cars.

Cleveland makers of motor cars and trucks consumed in building their 1919 output 52,000 tons of iron and steel, and the amount required on their 1920 schedules is estimated at 170,000 tons. This includes soft steel, special and alloy steels in all finished forms that are used in motor car construction, and the iron that is used in the motor castings and other parts. During the year two makers of automobile frames in Cleveland, much of whose product goes to car builders in the Michigan territory, consumed 86,000 tons of sheets and light plates in the manufacture of automobile frames and their 1920 schedules call for the consumption of 117,000 tons of steel in this work.

The demand for steel for rims, as a result of the extension of the automobile industry, has become enormous, and manufacturers of rims in the Cleveland territory have become among the largest consumers of steel in that district, which is the center of the rim-making industry. During 1919 approximately 218,000 tons of steel was consumed by rim manufacturers in the territory, located in Cleveland, Akron and Warren, and the requirements of these consumers is expected to be considerably larger during this year. One of the rim manufacturers, the Goodyear Tire & Rubber Co., Akron, is planning the erection of a large new rim plant which will doubtless materially increase that company's steel requirements. The steel used in the manufacture of rims includes special sections rolled to meet the customer's specifications, bands for rims for the smaller types of passenger cars, S. A. E. bands for both passenger cars and trucks, and special sections, flat bars and universal plates for large passenger cars and trucks. Probably about one-half of the steel required by the rim manufacturers in the territory is in the form of special sections.

In addition to the requirements of the frame and rim manufacturers a large tonnage of steel, largely in the form of bars and sheets, is consumed by Cleveland manufacturers of axles, forgings, stampings and other makers of automobile parts, much of whose products are shipped to automobile builders in other territories, and the amount of pig iron consumed by Cleveland foundries in making gray iron, steel and malleable castings for passenger and motor trucks is very large and is increasing every year.

The most important addition to the motor car industry in Cleveland during 1919 was the Cleveland Automobile Co., which placed a new plant in operation late in the year, and plans to build 20,000 cars in 1920. The 1919 output of cars by other Cleveland makers and their 1920 schedules are as follows:

Chandler Motor Car Co., 1919, 20,000 cars; 1920, 30,000. Peerless Motor Car Co., 1919, 5000; 1920, 8000. Grant Motor Car Corporation, 1919, 7500; 1920, 15,000. F. B. Stearns Co., 1919, 2450; 1920, 5000. Jordan Motor Car Co., 1919, 2500; 1920, 5000. Winton Co., 1919, 2300; 1920, 6000. Templar Motors Corporation, 1919, 2500; 1920, 10,000. One other addition to the motor car industry in the Cleveland territory is a new plant recently established by the Maibohm Motors Co., Sandusky, Ohio, which has a production schedule for 1920 of 7500 cars, requiring 5625 tons of steel and 1825 tons of iron.

During the past year the Cleveland Automobile Co. erected a four-story plant, 800 x 80 ft., and is now building a four-story addition, 220 x 80 ft. The Chandler Motor Car Co. is at present increasing the capacity of its plant 35 per cent, having under construction two four-story buildings, one 500 x 60 ft., and the other 80 x 400 ft. The White company is building large extensions to its motor truck plant, the Stearns Co. is adding 100,000 sq. ft. of floor space, the Jordan company has built a one-story addition, 100 x 300 ft., a two-story addition, 97 x 164 ft., and acquired another one-story building 100 x 300 ft.; the Peerless company has made some extensions and the Grant and the Templar corporations are now enlarging their plants.

Considerable speculation is being indulged in as to when the manufacturing capacity of the automobile companies will catch up to the demand for cars. During the past year, owing partly perhaps to the fact that production was largely curtailed during the war, the demand was greatly in excess of the supply, and the general opinion is that with their increased

production and the tremendous demand motor car plants will have all the orders they can fill until next fall, at least.

The automobile parts industry in Cleveland also grew materially during the year, some new plants being built, extensions being made to others, and some not yet having reached the construction stage. A new plant was built by the Jones Gear Co. and the Murray Ohio Mfg. Co. established a plant for making hoods, fenders and other sheet metal parts for automobiles. A large plant will be erected by the Fisher Ohio Body Corporation, and the Ohio Blower Co., which recently changed its name to the Ohio Blower & Body Co., has placed contracts for large plant extensions to increase its production of bodies and other automobile parts. A large plant extension is also being built by the Mullins Body Corporation, Salem, Ohio. The Timken Roller Bearing Co., Canton, erected during the year a large bearing plant in Columbus, Ohio. Projected plants include a large factory to be erected in Cleveland by the recently organized Eaton Axle Co. The Parish & Bingham Co. is building a large addition to its Canton plant for making frames, and the Hydraulic Pressed Steel Co. is materially enlarging its frame-making capacity by adding additional equipment. A number of other metal-working plants whose products go largely or wholly to the automobile industry were also enlarged during the year.

Automotive Industries Large Buyers at Chicago

IN the year just closed purchases of machine tools in the Chicago district by the automotive industry aggregated considerably over $3,000,000. In the territory tributary to Indianapolis orders totaled about $750,000. According to estimates by leading Chicago tool dealers the largest individual purchases in Chicago territory were as follows:

Samson Tractor Works, Janesville, Wis., $900,000; Nash Motors Co., Kenosha and Milwaukee, Wis., $800,000; Studebaker Corporation, South Bend, Ind., $700,000, of which $250,000 represented purchases of Government tools; Continental Motors Corporation, Muskegon, Mich., $600,000; Advance-Rumely Co., Laporte, Ind., and Battle Creek, Mich., $200,000; Mitchell Motors Co., Racine, Wis., $100,000; Moline Plow Co. for tractor plant, Moline, Ill., $100,000, of which about three-quarters was bought from Government; J. I. Case Threshing Machine Co., large manufactures of tractors and automobiles, Racine, Wis., $100,000; A. O. Smith Corporation, Milwaukee, Wis., $50,000; Continental Axle Co., Edgerton, Wis., $50,000; Wisconsin Parts Co., Oshkosh, Wis., $35,000; Buda Co., Harvey, Ill., $25,000. Total for Chicago district, $3,660,000.

In the Indianapolis territory the Stutz Motor Car Co. of America purchased $250,000 worth of machine tool equipment. Other purchases in that district are estimated as follows: Haynes Automobile Co., Kokomo, Ind., $100,000; Nordyke & Marmon Co., Indianapolis, $75,000; Lafayette Motors Co., Indianapolis, $75,000; Apperson Bros. Automobile Co., Kokomo, Ind., $50,000; Teeter Hartley Motor Co., Hagerstown, Ind., $40,000; Indiana Silo & Tractor Co., Anderson, Ind., $35,000; Graham Bros., Evansville, Ind., $25,000; General Motors Corporation, Muncie, Ind., plant, tool room equipment, $25,000; Monroe Motor Co., Indianapolis, $20,000. Total for Indianapolis district, $695,000.

Demand for Steel from Automobile Builders

THE only concern in the Pittsburgh district that builds automobiles complete is the Standard Steel Car Co., whose works are at Butler, Pa. However, there are in Pittsburgh a few concerns that build trucks complete, either gasoline or electric. While it is not possible to secure accurate figures as to the increase in demand for various forms of steel used in the building of automobiles and trucks, information secured from several of the larger steel companies in the Pittsburgh district, notably those making a specialty of the manufacture of automobile sheets, indicates that the demand for steel in 1919 from the automobile builders showed an increase over the previous year of 20 to 25 per cent. In fact, there has been for some time a shortage in capacity for making special sheets for automobile builders, one leading manufacturer stating that this shortage in capacity is as much as 25 per cent. That this is true is attested to by the fact that in the closing two months of 1919 automobile builders were very short in supply of sheets, and several large builders of cars offered as much as $20 a ton premium to sheet mills if they would make fairly prompt shipments. Of course there was a large falling off in output of sheets on account of the steel strike, and part of the scarcity in supply late in the year was due to loss of production during the strike. However, there is no doubt that the expansion of the automobile industry is very much larger than expansion in capacity for making automobile sheets, and that there will be a shortage in supply for some time. From a reliable authority it is learned that the consumption of sheets of all kinds entering into the manufacture of automobiles is from 750,000 to 1,000,000 tons per year, probably all of the latter quantity.

What is said in regard to expansion in demand for automobile sheets applies also to other grades of steel used in the building of cars. In the second half of 1919 makers of cold-rolled steel bars and other similar products used in the manufacture of cars had a very heavy demand for their products, and at times were very much back in deliveries. There seems to be no doubt that all the steel manufacturers who make steel used in the manufacture of pleasure cars and trucks will have a very heavy demand for their products during all of this year. Some of the larger automobile companies are making additions to their plants, which will very greatly increase their output of cars this year over last year.

Revival of the Industry in New England

AFTER a long period, during which the New England automobile and truck manufacturing industry either stood still or slipped backward, there are undisputed evidences of its going forward. Up to the time that this country entered the war the automobile and truck manufacturers of New England operated at a disadvantage. They were far removed from the big steel mills of the country. Railroad freight rates were distinctly against them. Their supply of labor was constantly threatened, inasmuch as it was attracted by the high wages paid by the automobile industry in the Middle West and elsewhere.

One by one the New England manufacturer found it necessary to move westward, to sell his patent rights, to suspend operations, or to pass through bankruptcy. Only the strongest could withstand the competition of the manufacturer located in other parts of the country.

Then came the war. The New England manufacturer was able to produce Government munitions under ruling contracts as was the Western. Almost by the stroke of the pen his raw material, freight, and above all, his labor problems vanished. The war ended found him fortified financially.

Wages of labor in the meantime advanced in the East to a basis which compared favorably with those paid in the West, when the cost of living in the two sections of the country is weighed. The chances of obtaining a home for his family by the machinist were

better in New England than in the Middle West, although this question was a serious one the country over. In the early part of 1919 it was very evident that the westward flow of skilled labor was in ebb.

There was an abnormal demand for automobiles, which the Western manufacturer could not fill. Prices for such machines were sufficient to allow the Eastern manufacturer a profit. On June 30 last the New England industry found itself in an unusually prosperous condition. Since then its affairs have further improved.

Manufacturers who had discontinued the construction of automobiles and trucks and confined themselves to the production of parts are seriously considering a re-entering of the abandoned field. In instances where construction plans were first laid in 1918 great progress has been made in plant expansion, plant equipment and production. The Northway Motor Co., Natick, Mass., is a case in point. That corporation to-day has a plant of sufficient size and well equipped to make it a factor in the motor field.

The Stevens-Duryea name is to be placed on the list of active producers once more. Western and Eastern capital have combined here; its plants in western Massachusetts will compare very favorably with many of those located in the Middle West both in size and equipment. The Locomobile Co., Bridgeport, Conn., has been reorganized in a financial as well as a working way, and bids fair to become a highly important unit in the automotive industry of the country.

The establishment of the Rolls-Royce Co. of America at Springfield, Mass., is another indication that New England is coming back in the automobile field. This corporation was fortunate enough to secure a plant sufficiently adapted to the manufacture of high-grade cars and enough equipment to place it in the productive field at a very early date. It is possible that the action of this company in locating in New England will be a highly important factor in the labor situation.

Although plans are in the premature stage, it is known that financial arrangements are being made which, if successful, will result in a further expansion of the New England automobile industry.

Disposing of War's Immense Surplus

How the War, Navy and Other Departments of the Government Have Conducted the Demobilization of Steel and Machinery—Secretary Baker's Tribute to Business Men

BY OSWALD F. SCHUETTE

GOVERNMENT participation in private industry during 1919 slumped to an emphatic ebb from the floodtide of Government control which marked the feverish war days of 1918. Yet the remnants of the war powers which the Government has retained far exceed anything of the pre-war days. How permanent some of these will be Congress must decide.

As far as the iron and steel industry is concerned, this control is evidenced chiefly by three important wartime bodies—the Fuel Administration, the Railroad Administration, and the Shipping Board. The first will end definitely with the final proclamation of peace, although its handling of the coal strike was as vigorous as though the war were not 13 months behind us. The future of the Railroad Administration and the Shipping Board is in the hands of the Congress. The latter no longer figures in the steel markets, except as a seller of ships and of surplus materials. The Railroad Administration is buying as little as possible, but its control powers inherited from the Fuel Administration have made it a more important factor in industrial problems. Although the administration has repeatedly declared its desire to return the roads to private ownership, it would not be surprising if it used the Railroad Administration as long as possible to execute any ukase which the executive authorities of the Government see fit to exercise against private industry. For such a purpose there is no discounting the value of the Railroad Administration—the coal strike revealed its power.

End of the War Industries Board

The War Industries Board, which was the most powerful governmental agency in the control of industries during the war, died early in the year, having practically abandoned most of its functions at the close of 1918. The preferential list of industries, which had been so complicated a problem and which had caused so much worry to industries as well as to the Government officials, went automatically into the wastebasket when the hostilities ceased, and the need for minute distinctions in the allocation of material and the supply of raw materials, fuel, labor, transportation and capital was ended. Price fixing was abandoned at the same time.

In the place of these functions, it was expected that the Government would set up some machinery for the definite guidance of industrial reconstruction. Nothing of this kind, however, was done, except for the ill-fated Redfield Industrial Board, which sought to introduce Government guidance for price increases, but was wrecked almost at its launching by a clash with the Railroad Administration. The latter refused to accept its rail prices, although it paid them later—when after delaying the resumption of railmaking for six months, it found it impossible to get its orders filled because of the steel strike.

The Hands-Off Policy

Except for the Industrial Board, the Government played a pretty consistent policy of "hands off" industry. It did tackle the labor problem under various guises, but with little good fortune. The first presidential labor conference ended in shipwreck and the second faded off the horizon and the first pages of the newspapers with promises of later reappearance as the proponent of relief. The Department of Labor played safe as to the threat of a steel strike by ignoring it, and a senatorial investigation gave little relief, although it did shed a lot of much needed light on the Bolshevist influences which had undermined the American Federation of Labor and forced the steel strike. In face of the coal strike, the Department of Labor came out into the open as the advocate of labor demands. At first Fuel Administrator Garfield, backed by part of the President's cabinet, fought the unions, and was supported by drastic court measures, but later the administration succeeded in getting the miners to return to work, but the operators objected to the plan of adjustment.

Dr. Garfield Resigned

It is difficult to forecast what the year 1920 will bring forth. Promises of antistrike legislation in connection with the railroad laws, will stir up the matter anew, and the expectation is that the President will align himself with the labor unions. In the background there is always the peril of a nation-wide railroad strike whenever the Government stops granting periodical wage increases, or turns the roads back to private owners who cannot afford the recordbreaking Government payrolls.

The War and Navy Departments stepped out of the industrial problem as the heaviest purchasers of iron and steel and became sellers of their surplus accumulations. The Navy surplus, however, was small and was quickly disposed of to other Government departments. But the Army had billions of dollars worth of wares on both sides of the Atlantic for which the ces-

sation of hostilities had left no further use. Besides this there was an enormous total of unfinished contracts whose termination threatened industrial disaster unless handled with judgment.

Work Still to Do

This work is not yet completed. The adjustment of contracts has proceeded with apparent smoothness and speed. The disposition of surplus properties has run into many obstacles, and there is much work left to be done. From an industrial standpoint this has not been such a great hardship, for it has kept large stocks of wares off the market during months when industries turning from war to peace work were least able to stand competition. The Government has lost to some extent by this fact, but there has been some unexpected salvage, due to the fact that the interim has been marked by increasing prices, and many of the unsold wares can be sold at better prices to-day than a year ago.

As a whole, however, the Government's sacrifice will prove a heavy one. In round numbers, Secretary Baker of the War Department has estimated the total surplus property held by the War Department in Europe and in the United States, at the close of the war, at $3,680,-500,000. Of this amount only $2,582,000,000 has been sold, and that at a price of $1,314,000,000, thus netting a recovery of 51 per cent of cost. He has made no estimates, however, of the possible realization value of the approximate remainder of $1,100,000,000.

Of these totals, the surplus in the United States aggregated in cost $2,000,000,000. The portion sold aggregated in cost, $902,000,000, for which a return of $687,000,000 was realized, or 75.3 per cent.

The property abroad represented a cost value of $1,680,500,000. For this, the Government received $627,000,000. This includes $400,000,000 in French 5 per cent bonds, which bear no interest until next July, and which were paid in a lump sum for property that cost us $1,400,000,000, although Secretary Baker estimates that its actual replacement value was only $800,-000,000. On a basis of cost values, our foreign sales netted us a return of 37.3 per cent, but on a basis of estimated replacement values, the percentage rises to 62.7 per cent.

Work of Director of Sales

During most of the year, C. W. Hare was Director of Sales, but he resigned Oct. 21, and was succeeded by E. C. Morse, who had been his first assistant. In speaking of the work of this office, Secretary Baker said:

"The problem confronting the Director of Sales was the disposal of the property accumulated in this country at a time when general industrial conditions were in a chaotic state, in such a way as not to unnecessarily disturb industrial conditions and at the same time realize a maximum return to the treasury. Producers were endeavoring to get back to a peacetime basis, after working almost entirely on war orders. There was at the time a large percentage of unemployed labor which was being, or was about to be, increased by the demobilization of about four and a half million soldiers and sailors. Late in the spring it was seen that conditions were becoming more stabilized and producers and labor resumed activities. From then on less thought was given to this aspect and efforts were made by the War Department to put into the hands of the consumer such surplus as subsistence and clothing at reasonable prices, so as to assist as much as possible in reducing the high cost of living."

In the detailed itemization of the property sold in the United States, the department has received $10,-893,848 from its sales of ferrous metals including scrap. Of this, the cost of $7,903,757 sales returns was $32,173,982, while as to the remainder the cost figure was unknown. The proceeds from hardware sales were $1,716,597, of which $1,462,965 represented a cost value of $2,653,475. Machinery and engineering equipment brought in $4,532,518, of which $4,323,603 was represented by a cost value of $6,997,747. The motor and equipment sales netted $1,993,511 representing almost $7,000,000 in cost values.

One of the biggest items was railroad rolling stock, which brought in $70,157,122 on a cost of $71,512,253. For railway materials, the Government received a total of $1,549,907 on a cost value of approximately $2,200,-000.

Machine Tool Policies

Few items of surplus have been marked by such a divergence of programs and plans as that of machine tools. Near the end of the year the sales had aggregated $4,388,892, of which $3,533,889 represented an original cost of $5,850,646. Much of this material, however, was second hand, although the cost was put down at the original figure. No inventory has yet been made up to give the value of the stocks that are left.

In the last days of the year, the War Department sold $25,000,000 worth of machine tools to the French Government. The contract covers all of 1920, during which time the representatives of the French government are to have the privilege of selecting tools to the amount of the contract from the surplus stocks left unsold. The payments are to be made in 10-year 5-per cent bonds of the French Republic, payable in dollars at Washington. The prices will be fixed according to the old price-fixing chart of the War Department, which is no longer used in domestic sales. All machine tools on hand, however, will continue to remain open to domestic purchasers until actually selected by the French representatives.

Much of the delay in disposing of the Government's surplus of machine tools has been due to the pressure from the industry to prevent a demoralization of the market conditions here as well as abroad. Several methods have been tried during the year. Throughout the spring the Government tried to work out a plan by which the machine tool industry would itself handle the surplus machine tools and dispose of them with its own wares on the basis of a special agreement with the Government. This, however, did not succeed. Late in the summer an elaborate plan was announced by which there was to be an automatic appraisement of the values of the machine tools held by the Government. This was accompanied by intricate charts which were to reveal at a glance the exact values of each machine. When it came to putting this into practice, however, it failed to operate because it was based entirely on the original value of each tool, and paid no attention to existing market conditions. So a new policy was announced in December by which future appraisements would be based "on the actual physical inspection of the tool, determined by visual inspection, the strength of the second-hand tool market rated at a percentage, and the prevailing market price or a new machine tool of like style and size."

Sales to Belgian Buyers

Approximately 2500 of these surplus machine tools were sold in September to La Construction Metallique, a co-operative society composed of approximately 500 Belgian industrial establishments. The individual tools are still being selected by the Belgian representatives, and the total amount to be realized from these sales is estimated at something less than $5,000,000. Efforts are still being made to sell some of these tools to the reconstructed French industries. The efforts, however, are not being confined to Europe. After a year of slow sales in the United States the War Department has apparently put a little more steam behind the domestic sales. In recording the European sales Director Morse announced in November the new policy of the department:

"There is a strong demand on the part of American users of machine tools for certain types of tools of which the War Department has a stock. The American manufacturers need these tools to increase their production and enhance the wealth of the nation. They are willing to pay good prices for those which they desire to acquire. The War Department stands ready to sell its surplus stock of machine tools to these domestic users. It is filling its machine tool orders in the sequence of their receipt. No machine tool is being held off the market to be applied upon the Belgian contract. Tools are consigned to that contract only

after they have been actually selected by the Belgian representatives. The surplus supplies held by the War Department were acquired with funds furnished by the American people; the War Department proposes to give the American people the opportunity to derive any benefit that may inure to them through the sale of these surplus stocks."

At the same time the Machine Tool Division of the office of director of sales began to issue complete inventories of machine tools on hand. The making of these inventories had been apparently a difficult task and had proceeded with great slowness through the spring and summer months. Since that time periodic revisions of these inventories have been issued, and sent out to possible purchasers, with detailed descriptions of each machine still in the hands of the Government, giving the type of machine, the maker, the cost to the Government, and the present condition on a percentage basis.

Adjusting Contracts

Another great War Department task that resulted from the war was the adjustment of uncompleted contracts, whose completion was made unnecessary by the armistice. Congress passed a special law, the Dent act, early in the special session, conferring this authority on the Secretary of War, and at the same time empowering him to regularize various irregularly made contracts under which industrial establishments had undertaken to furnish materials in good faith. These settlements have already cared for $2,091,435,426 worth of contracts, at their ultimate cost, by a payment of $252,160,382—an apparently small percentage, although it must be remembered that on many of these contracts no actual work had been done.

"Many industries had their entire working capital invested in the claims," said Secretary Baker, in reporting on these adjustments, "and until they were paid, or their claims at least liquidated, it was impossible to proceed with the execution of peacetime orders which had begun to present themselves. The realization to the business man was a call to further sacrifice for the common good, and there have been throughout the year, and still are, large numbers of men in the service of the Government foregoing assured rewards in private business in order that they may see this thing through and aid in the restoration of a settled and safe industrial condition in the country.

"It is proper at this time to express to the contractors with whom the Government has negotiated appreciation of the prevailing spirit of cooperation in furnishing desired information and of toleration for the occasional annoying delays incident to so complicated an undertaking. Although the claims as presented have frequently been cut to substantially lower figures, it remains true that deliberate attempts to impose upon the Government have been notably few. In fact, it may be said that the fine industrial morale developed during the war has continued into the transition period and has supported the efforts of the War Department to ascertain and liquidate its obligations in the shortest possible time."

The elaborate machinery for the production of war supplies which the Government built up in 1917 and 1918 was ruthlessly torn down in 1919. Huge projects were entirely abandoned, and the work which had been done by private industry to make possible the winning of the war was sacrificed with speed. Only skeleton organizations have been maintained to meet the needs of possible future wars. The chief element in this work for the future will be a reliance that the retention of jigs and dies and a certain amount of machinery in the various arsenals will be sufficient nucleus for a speedy resumption of quantity production whenever a new emergency may present itself.

The Status of the Electric Steel Industry

United States Still Leads in Output with 323 Furnaces, a Gain of 12 Per Cent in 1919—Furnaces in World's Steel Industry at Least 875

BY EDWIN F. CONE

WHILE the expansion in the electric steel industry of the United States and Canada was not as large in 1919 as it was in 1917 and 1918, the growth, so far as new installations of furnaces is concerned, was considerably larger than expected. Because of the confusion in Europe as a result of the war and the breaking up of some countries which have been prominent in this industry, data as to developments there have had to be omitted in this review for the first time.

On Jan. 1, 1919, according to THE IRON AGE'S annual review of the electric steel industry published in the issue of Jan. 2, 1919, the United States was credited with 287 electric furnaces of all types, with 43 in Canada. On Jan. 1, 1920, this total has been increased to 323 in this country with 40 in Canada. Only seven and one-half years ago, or on July 1, 1913, there were only 19 such furnaces in this country and three in Canada. The total in the world on Jan. 1, 1919, was estimated at 815. It is probably at least 875 now. Seven and one-half years ago this total was only 140.

A review of this industry was inaugurated by THE IRON AGE, the first data appearing in the issue of July 1, 1913. The first estimate of this kind appeared in *Stahl und Eisen* which THE IRON AGE amplified for its issue of April 14, 1910. This review has appeared annually in each Annual Review Number beginning in January, 1915.

The review which follows gives complete data as to every type of furnace concerning which it has been possible to obtain information. Separate tables of many of the types are given which show the present installations and the product to date, both in the United States and Canada. The Moore furnace is the only exception. The data is particularly accurate as to the United States and nearly complete as to Canada. It has been impossible to compile data as to the world, and the table of a year ago is repeated as a matter of information. It is hoped to amplify this a year from now.

Progress in the United States and Canada

The net increase in the number of furnaces in the United States in 1919 has been 36 against 54 in 1918, 97 in 1917 and 63 in 1916. The total is now 323 against 287 on Jan. 1, 1919; 233 on Jan. 1, 1918, and 136 on Jan. 1, 1917. The apparent net increase of 36 in the last year is less than the actual, due to cancellation of contracts or the passing out of commission of some installations. The growth of the industry is appreciated when it is recalled that there were only 19 furnaces of all types in the United States on July 1, 1913.

In Canada the expansion has been a net loss of three furnaces, or from 43 on Jan. 1, 1919, to 40 on Jan. 1,

Table of Heroult Electric Furnaces, Operating or Contracted for, as Licensed by United States Steel Corporation, in the United States and Canada, Jan. 1, 1920.

Company and Location	No. of Furnaces	Size, Tons	Product
Alaska-Treadwell Gold Mining Co., Treadwell, Alaska	1	2	Castings
American Manganese Steel Co., Oakland, Cal.	1	3	Castings
American Steel Foundries, Indiana Harbor, Ind.	1	6	Castings
Anniston Steel Co., Anniston, Ala.	5	6	Castings and pig iron
Armstrong, Whitworth of Canada, Ltd., Longueil, Que.	1	3	Ingots
Armstrong, Whitworth of Canada, Ltd., Longueil, Que.	3	6	Ingots
Atlas Crucible Steel Co., Dunkirk, N. Y.	1	3	Ingots
Atlas Crucible Steel Co., Dunkirk, N. Y.	1	6	Ingots
Baldwins Canadian Steel Corporation, Ltd., Toronto, Can.	10	6	Ingots
Belle City Malleable Iron Co., Racine, Wis.	1	3	Castings
Best Steel Casting Co., Oakland, Cal.	1	6	Castings
Bethlehem Steel Co., Bethlehem, Pa.	1	3	Castings
Bethlehem Steel Co., Bethlehem, Pa.	1	6	Ingots
Braeburn Steel Co., Braeburn, Pa.	2	6	Ingots
Buchanan Electric Steel Co., Buchanan, Mich.	1	2	Castings
Buchanan Electric Steel Co., Buchanan, Mich.	1	3	Castings
Buckeye Steel Casting Co., Columbus, Ohio	1	6	Castings
Carbon Steel Co., Pittsburgh	1	6	Ingots
Carnegie Steel Co., Duquesne, Pa.	1	25	Ingots
Carpenter Steel Co., Reading, Pa.	4	6	Ingots
Connecticut Electric Steel Co., Inc., Hartford, Conn.	2	2	Castings
Crane Co., Chicago, Ill.	1	6	Castings
Crucible Steel Casting Co., Cleveland, Ohio	1	1	Castings
Crucible Steel Casting Co., Lansdowne, Pa.	1	2	Castings
Crucible Steel Co. of America, Atha Works, Harrison, N. J.	1	3	Ingots
Crucible Steel Co. of America, Atha Works, Harrison, N. J.	3	6	Ingots
Crucible Steel Co. of America, Park Works, Pittsburgh	2	6	Ingots
Crucible Steel Co. of America, Sanderson Works, Syracuse, N. Y.	2	3	Ingots
Damascus Crucible Steel Casting Co., New Brighton, Pa.	1	2	Castings
Disston, Henry, & Sons, Inc., Philadelphia	1	3	Ingots
Dominion Foundries & Steel, Ltd., Hamilton, Can.	2	6	Castings
Driscoll-Reese Steel Co., Hamburg, Pa.	1	1	Castings
Driver-Harris Co., Harrison, N. J.	2	2	Castings
Electric Steel & Forge Co., Cleveland	1	6	Ingots
Electric Steel Co. of Indiana, Indianapolis, Ind.	1	3	Castings
Electric Steel & Metals Co., Ltd., Welland, Can.	2	6	Ingots
Firth-Sterling Steel Co., McKeesport, Pa.	2	3	Ingots
Fort Pitt Steel Casting Co., McKeesport, Pa.	1	3	Castings
General Electric Co., Schenectady, N. Y.	1	5	Castings
General Electric Co., Schenectady, N. Y.	2	2	Castings
General Electric Co., Schenectady, N. Y.	1	1	Ingots
General Electric Co., West Lynn, Mass.	1	6	Castings
General Electric Co., Erie, Pa.	1	6	Castings
General Electric Co., Pittsfield, Mass.	1	1	Experimental products
Halcomb Steel Co., Syracuse, N. Y.	1	4	Ingots
Halcomb Steel Co., Syracuse, N. Y.	3	6	Ingots
Harrow Spring Co., Kalamazoo, Mich.	1	6	Ingots
Heppenstall Forge & Knife Co., Pittsburgh	2	6	Ingots
Hess Steel Corporation, Baltimore, Md.	6	6	Ingots
Hub Electric Steel Casting Co., Boston, Mass.	1	2	Castings
Hussey-Binns Steel Co., Charleroi, Pa	1	6	Ingots
Illinois Steel Co., South Chicago, Ill.	2	15	Ingots
Illinois Steel Co., South Chicago, Ill.	3	25	Ingots
Illinois Steel Co., Joliet, Ill.	1	4	Molten ferro-manganese
Latrobe Electric Steel Co., Latrobe, Pa	1	3	Ingots
Latrobe Electric Steel Co., Latrobe, Pa.	2	6	Ingots
Lebanon Steel Foundry, Lebanon, Pa.	2	2	Castings
Lemoyne Steel Co., Monongahela, Pa.	1	2	Ingots
Lenni Steel Co., New Castle, Del.	1	6	Castings
Lenni Steel Co., Lenni, Pa.	1	6	Ingots
Llewellyn Iron Works, Los Angeles, Cal.	1	3	Castings
Lunkenheimer Co., Cincinnati	1	1	Castings
Michigan Steel Casting Co., Detroit, Mich.	1	6	Castings
Michigan Steel Casting Co., Detroit, Mich.	2	3	Castings
Midvale Steel & Ordnance Co., Nicetown, Phila., Pa.	1	6	Ingots
Millbury Steel Foundry Co., Millbury, Mass.	1	2	Castings
Milwaukee Steel Foundry Co., Milwaukee, Wis.	1	3	Castings
Monarch Foundry Co., Stockton, Cal.	1	1	Castings
National Malleable Casting Co., Sharon, Pa.	2	6	Castings
National Malleable Casting Co., Grant Works, Chicago	3	6	Castings
National Malleable Casting Co., Cleveland	2	15	Castings
Newport News Shipbuilding & Dry Dock Co., Newport News, Va.	1	6	Castings
Ontario Electric Steel Co., Fulton, N. Y.	1	1	Ingots
Ontario Electric Steel Co., Fulton, N. Y.	1	6	Ingots
Pennsylvania Engineering Works, Newcastle, Pa.	1	6	Castings
Pettibone-Mulliken Co., Chicago	1	2	Castings
Railway Steel Spring Co., Latrobe, Pa.	1	3	Ingots
Simonds Manufacturing Co., Lockport, N. Y.	2	6	Ingots
Sizer Forge Co., Buffalo, N. Y.	2	10	Ingots
Southern California Iron & Steel Co., Los Angeles, Cal.	1	6	Ingots
Southern Pacific Co., Sacramento, Cal.	1	6	Ingots and castings
Spencer Heater Co., Scranton, Pa.	1	3	Castings
Standard Seamless Tube Co., Economy, Pa.	1	15	Ingots
Standard Stoker Co., Erie, Pa.	1	2	Castings
Taylor, W. P. Co., Buffalo, N. Y.	1	2	Castings
Taylor-Wharton Iron & Steel Co., Highbridge, N. J.	1	3	Castings
Taylor-Wharton Iron & Steel Co., Easton, Pa.	1	6	Castings
Tennessee Coal, Iron & Railroad Co., Ensley, Ala.	1	6	Molten ferro-manganese
Timken-Detroit Axle Co., Canton, Ohio	1	2	Castings
Timken Roller Bearing Co., Canton, Ohio	4	6	Ingots
Treadwell Engineering Co., Easton, Pa.	1	2	Castings
Trojan Electric Steel Co., Chicago, Ill.	1	1	Ingots
Tungsten Steel Co., Toledo, Ohio	1	¼	Cast tool
Twin City Forge & Foundry Co., Stillwater, Minn.	1	1	Castings
Union Electric Steel Co., Carnegie, Pa.	1	6	Ingots
Union Spring & Manufacturing Co., New Kensington, Pa.	1	6	Castings
United Alloy Steel Corporation, Canton, Ohio	1	6	Ingots
United Alloy Steel Corporation, Canton, Ohio	2	15	Ingots
U. S. Government, Watertown Arsenal, Watertown, Mass.	1	2	Castings
U. S. Government, Watertown Arsenal, Watertown, Mass.	2	6	Ingots
U. S. Government, Naval Gun Factory, Washington, D. C.	1	6	Castings
U. S. Government, Naval Projectile Factory, Charleston, W. Va.	3	6	Ingots
U. S. Government, Naval Ordnance Factory, Charleston, W. Va.	2	30	Ingots
Universal Rolling Mill Co., Bridgeville, Pa.	3	6	Ingots
Vanadium Alloys Steel Co., Latrobe, Pa.	2	3	Ingots
Vulcan Crucible Steel Co., Aliquippa, Pa.	1	3	Ingots
Warman Steel Casting Co., Los Angeles, Cal.	2	3	Castings
Warren Steel Casting Co., St. Louis, Mo.	1	2	Castings
Warren Steel Casting Co., St. Louis, Mo.	1	3	Castings

Summary:	Furnaces
Total in the United States, including Alaska	152
Total in Canada	18
Total in the United States and Canada	170

1920, due largely to the discontinuance of some synthetic iron furnaces. The actual new installations would show a gain. On Jan. 1, 1917, there were only 19 furnaces in Canada and only three on July 1, 1913.

The increase in the two countries has been 33 furnaces in 1919 against 61 in 1918, or from 330 on Jan. 1, 1919, to 363 on Jan. 1, 1920.

The table of Heroult furnaces this year gives all those that are now in existence or licensed to operate up to Jan. 1, 1920. The total of this type on Jan. 1, 1920, was 152 in the United States and 18 in Canada, or 170 in both countries, as contrasted with 163 in the United States and Canada on Jan. 1, 1919. The actual number of furnaces licensed in 1919 was 14 as against 22 in 1918. The expansion in 1917 was abnormal and due to war conditions, while that for 1918 and 1919 was more normal. This is true of other types of furnaces as well. A feature of the 1919 development is the installation of two 30-ton furnaces at the Naval Ordnance Factory of the Government at Charleston, W. Va. The Heroult furnace continues to maintain its leadership in installations and output. The installations in the United States exceed that of its nearest competitor by over 100, the Snyder being credited with 46.

The Snyder furnace expanded its representation in 1919 more than is shown by the tables. It is now credited with 46 in the United States and three in Canada as against 45 in the United States and three in

Table of Rennerfelt Electric Steel Furnaces Operating or Contracted for in the United States, Jan. 1, 1920, as Sold by Hamilton & Hansell, New York

Company and Location	Capacity, Lb.	Product
American Foundry & Machine Co., Salt Lake City, Utah	6600	Castings
Skagit Steel & Iron Works, Sedro Woolley, Wash.	2200	Castings
Best Steel Castings Co., Oakland, Cal.	2200	Castings
The Parsons Co., Newton, Iowa	2200	Castings
Maynard Steel Castings Co., Milwaukee, Wis.	2200	Castings
Pacific Foundry Co., San Francisco, Cal.	750	Pig iron
Chile Exploration Co., New York City	1000	Special iron
Hamilton & Hansell, New York City	500	Special testing
Oklahoma Iron Works, Tulsa, Okla.	2200	Castings
The Central Steel Co., Massillon, Ohio	2200	Melting ferro-manganese
Philadelphia Electric Steel Co., Conshohocken, Pa.	2200	Castings
Chicago Electric Steel Co., Chicago	2200	Tool steel
Liberty Steel Co., Morristown, N. J.	1000	Alloy steel
A. M. Byers Co., Pittsburgh	1000	Alloy steel
United States High Speed Steel & Tool Corporation	1000	Alloy steel
United States High Speed Steel & Tool Corporation	1000	Alloy steel
Haynes Stellite Co., Kokomo, Ind.	200	Alloy steel
Driver-Harris Co., Harrison, N. J.	300	Alloy steel

Total in the United States, 18.

Besides these there are 7 Rennerfelt furnaces operating in the United States and 1 in Canada in the non-ferrous industry.

Table of Greaves-Etchells Electric Steel Furnaces Operating or Contracted for in the United States on Jan. 1, 1920, as Sold by the Electric Furnace Construction Co., Philadelphia

Company and Location	Size, Tons	No. of Furnaces	Product
Norfolk Navy Yard, Norfolk, Va.	6	1	Castings
Puget Sound Navy Yard, Bremerton, Wash.	6	1	Castings
Mare Island Navy Yard, Mare Island, Cal.	6	1	Castings
Charleston Navy Yard, Charleston, S. C.	3	1	Castings
Philadelphia Navy Yard, Philadelphia, Pa.	3	1	Castings
American Radiator Co., Buffalo, N. Y.	6	2	Castings
American Radiator Co., Buffalo, N. Y.	½	1	Castings
Ford Motor Co., Detroit, Mich.	½	1	Alloy steels
Ford Motor Co., Detroit, Mich.	3	1	Alloy steels
Halcomb Steel Co., Syracuse, N. Y.	3	2	Alloy steels
Davidson Tool Mfg. Corp., New York	½	1	High speed steels
Hoskins Mfg. Co., Detroit, Mich.	½	1	
Sullivan Machinery Co., Claremont, N. H.	1	1	Castings
Dodge Steel Co., Philadelphia	3	1	Castings
Hammond Steel Co., Syracuse, N. Y.	3	1	Alloy steels
Vancouver Engineering Works, Vancouver, Canada	1	1	

Total in the United States, 17; Canada, 1.

There have also been sold a ½-ton furnace to the Imperial Japanese Mint, Osaka, Japan; a 1-ton furnace to Brasilian Military Commission, and a furnace to the Sociedad Espanola de Construccion Naval, Madrid, Spain.

Table of Electric Steel Furnaces Operating or Contracted for in the United States and Canada, Jan. 1, 1920, other than the Heroult, Snyder, Rennerfelt, Grönwall-Dixon, Greaves-Etchells and Booth Types.

Company and Location	Size, Tons	No. of Furnaces	Type
Bethlehem Steel Co., South Bethlehem, Pa.	10	1	Girod
Washington Iron Works, Seattle, Wash.	3 & 1	2	Girod
Electric Steel Foundry, Portland, Ore.	1	2	Girod
Washington Steel & Ordnance Co., Washington, D. C.	1	1	Stassano
American Iron & Steel Mfg. Co., Lebanon, Pa.	20	2	Induction
General Electric Co., Pittsfield, Mass.	2	1	Induction
Olympia Steel Foundry, Seattle, Wash.	¾	1	Greene
Olympia Steel Foundry, Seattle, Wash.	2½	1	Greene
Everett Steel Co., Everett, Wash.	¾	1	Greene
Aurora Foundry Co., Seattle, Wash.	1½	1	Greene
Pacific Car & Foundry Co., Renton, Wash.	1½	1	Greene
Capitol City Iron Works, Olympia, Wash.	1½	1	Greene
Dayton Malleable Iron Co., Dayton, Ohio	2½	1	Greene
Lamb Machine Co., Hoquiam, Wash.	1½	1	Greene
Malleable Steel & Iron Co., Tacoma, Wash.	½	1	Greene
Vulcan Mfg. Co., Seattle, Wash.	1¼	1	Greene
Canadian Klondyke Co., Dawson, Canada	3	1	Greene
Ludlum Steel Co., Watervliet, N. Y.	10	3	Ludlum*
Metal Alloys, Inc.	5	3	Ludlum
Hammond Steel Co., Syracuse, N. Y.	10	1	Ludlum
McCord Mfg. Co., Chicago	6	2	Ludlum
American Cast Iron Pipe Co., Birmingham, Ala.	6	1	Ludlum
Omaha Structural Steel Works, Omaha, Neb.	⅓	1	Ludlum
Westinghouse Electric & Mfg. Co., Trafford, Pa.	6	1	Ludlum
Old Dominion Iron & Steel Corporation, Richmond, Va.	3	2	Webb
Hercules Steel Casting Co., Milwaukee, Wis.	6	1	Vom Baur†
Moreland Motor Truck Co., Los Angeles, Cal.	3	1	Vom Baur
Moreland Motor Truck Co., Los Angeles, Cal.	½	1	Vom Baur
A Steel Casting Company, New York City	3	1	Vom Baur
Michigan Steel Castings Co., Detroit, Mich.	1	1	Detroit
Chrome Steel Works, Chrome, N. J.	1	1	Special
Tivani Electric Steel Co., Belleville, Ont.	3	1	Special
Canadian Brakeshoe Co., Sherbrooke, Que.	2½	4	Special
Canadian Brakeshoe Co., Sherbrooke, Que.	1	1	Special
Canada Cement Co., Montreal, Can.	6	4	Special
Wabi Iron Works, New Liskeard, Ont.	1	1	Special
Eastern Car Co., New Glasgow, N. S.	6	1	Special
Union Tool Co., Torrence, Cal.	½	1	Special
Union Tool Co., Torrence, Cal.	1	1	Special
Enterprise Foundry Co., San Francisco, Cal.	1	2	Special
Pittsburgh Valve, Foundry & Construction Co., Pittsburgh	1	1	Special
Onondaga Steel Co., Syracuse, N. Y.	1	1	Special
Hull Iron & Steel Foundries, Hull, Can.	6	1	Special
Alloy Steel Works, Ltd., Toronto, Can.	6	1	Special
Electric Smelting Co., Hull, Can.	6	1	Special
Aetna Iron & Steel Co., Port Moody, Can.	6	1	Special
Hesse-Martin Iron Works, Portland, Ore.	1	1	Special

Total in United States and Canada: Girod, 5; Stassano, 1; Induction, 3; Greene, 11; Ludlum, 12; Webb, 2; Vom Baur, 4; Special, 25. *Total*, 63.

*A Ludlum 3-ton furnace has been sold to the Consolidated Rolling Mills & Foundry Co., Inc., New York, for installation in Chile. There are also 9 Ludlum furnaces of special type making various ferroalloys for the Metal Alloys, Inc., Watervliet, N. Y. The Andes Electric Corporation, Coney Island, N. Y., also is using a special 3-phase Ludlum furnace for smelting tin ores.

†Four Vom Baur furnaces have been sold for installation in Japan and one 6-ton furnace to Le Fiaive et Cie., St. Etienne, France.

Canada in 1918. There were four new installations in 1919. On Jan. 1, 1918, there were only 35 Snyder

Table of Grönwall-Dixon Electric Steel Furnaces Operating or Contracted for in the United States and Canada on Jan. 1, 1920, as Sold by the John A. Crowley Co., New York

Company and Location	Size, Tons	No. of Furnaces	Product
The John A. Crowley Co., Detroit, Mich	12	1	Ingots
The John A. Crowley Co., Detroit, Mich.	6	1	Ingots
Old Dominion Iron & Nail Works Co., Richmond, Va.	6	1	Ingots
Norfolk & Western Railroad, Roanoke, Va.	3	1	Castings
United States Electric Steel Co., Connellsville, Pa.	12	1	Ingots
Jessop Steel Co., Washington, Pa.	3	1	Ingots
Calumet & Hecla Mining Co., Calumet, Mich.	3	1	Castings
Huntington Steel Foundry Co., Huntington, Ind.	3	1	Castings
Hartford Electric Steel Corp., Hartford, Conn.	3	1	Castings
Glover Machine Works, Marietta, Ga.	1	1	Castings
Ford Motor Co., Detroit, Mich.	¼	1	Castings
Cleveland Brass Mfg. Co., Cleveland	¼	1	Alloy steel castings
Bowmanville Foundry Co., Bowmanville, Ont.	¼	1	Castings

Total in the United States, 12; in Canada, 1.

furnaces in the two countries. The growth in two years has therefore been about 50 per cent.

The increase in the installations of some of the

Table of Booth Electric Steel Furnaces Operating or Contracted for in the United States Jan. 1, 1920, as Sold by the Booth Electric Furnace Co., Chicago.

Company and Location	Size, Tons	No. of Furnaces	Product
Midland Electric Steel Co., Terre Haute, Ind.	3	1	Ingots and pig iron
Avery Co., Peoria, Ill.	1½	2	Castings
Duriron Castings Co.	¾	1	Castings
West Michigan Steel Foundry Co., Muskegon, Mich.	3	1	Castings
Queen City Foundry Co., Denver, Col.	¾	1	Castings
Monroe Steel Castings Co., Monroe, Mich.	1½	1	Castings
Four Wheel Drive Auto Co., Clintonville, Wis.	1½	1	Castings
Ecorse Foundry & Machine Co., Ecorse, Mich.	3	1	Castings
Consumers Steel Corporation, Chicago, Ill.	3	1	Tool steel
New England Steel Castings Co., East Longmeadow, Mass.	1½	1	Castings
Union Motor Truck Co., Bay City, Mich.	1½	1	Castings

Total in the United States, 12.

other types is as follows: In 1919 the Ludlum has increased its installations from 11 to 12; the Booth, formerly called the Booth-Hall, from 11 to 12; the Moore from 12 to 20 and the Greene from 8 to 11. The Rennerfelt installations have grown in the last year from 13 to 18, while those of the Greaves-Etchells, the Grönwall-Dixon, the Girod and the Webb have changed but little in the aggregate number of installations.

The Booth Electric Furnace Co. recently put on the market a rotating electric brass furnace, described in THE IRON AGE, June 26, 1919. Fifteen of these have recently been sold.

Table of Snyder Electric Steel Furnaces Operating or Contracted for in the United States and Canada, Jan. 1, 1920, as Sold by the Industrial Electric Furnace Co., Chicago

Company	Location	Furnaces
Crucible Steel Casting Co.	Milwaukee, Wis.	1
Otis Elevator Co.	Buffalo, N. Y.	2
Gerlinger Steel Casting Co.	Milwaukee, Wis.	2
S. Fair & Son	Saginaw, Mich.	1
Niagara Electric Steel Corporation	N. Tonawanda, N. Y.	2
Sivyer Steel Casting Co.	Milwaukee, Wis.	1
Electric Steel Co.	Chicago, Ill.	2
Frog Switch & Mfg. Co.	Carlisle, Pa.	1
American Well & Prospecting Co.	Corsicana, Tex.	1
Monroe Steel Casting Co.	Monroe, Mich.	1
Pelton Steel Co.	Milwaukee, Wis.	2
Minneapolis Electric Steel Casting Co.	Minneapolis, Minn.	1
Western Crucible Steel Co.	Minneapolis, Minn.	2
Dayton Steel Foundry Co.	Dayton, Ohio	2
New London Ship & Eng. Co.	Groton, Conn.	1
Stearns-Rogers Mfg. Co.	Denver, Col.	1
Fairbanks Steam Shovel Co.	Marion, Ohio	2
West Steel Casting Co.	Cleveland, Ohio	1
Beaumont Iron Works	Beaumont, Tex.	1
Joyce-Cridland Co.	Dayton, Ohio	1
Henderson Iron Works & Supply Co.	Shreveport, La.	1
United Alloy Steel Corp.	Canton, Ohio	2
Standard Steel Casting Co.	Clearing, Ill.	2
Chile Exploration Co.	New York, N. Y.	1
Zimmerman Steel Co.	Bettendorf, Iowa	1
Atlantic Foundry Co.	Akron, Ohio	1
Buckeye Traction Ditcher Co.	Findlay, Ohio	1
Hubbard Steel Foundry Co.	East Chicago, Ind.	1
Western Steel Car & Fdy. Co.	Hegewisch, Ill.	2
Oil Well Supply Co.	Oil City, Pa.	1
Fluid Compressed Steel Co.	Keokuk, Iowa	1
Denver Rock Drill Mfg. Co.	Denver, Col.	1
Industrial Steel Castings Co.	Toledo, Ohio	1
Chrobaltic Tool Co.	Chicago, Ill.	1
Kinite Co.	Milwaukee, Wis.	1
Thos. Davidson Mfg. Co.	Montreal, Can.	1
Manitoba Steel Fdrys., Ltd.	Wimipeg, Can.	1
Canadian Brakeshoe Co., Ltd.	Sherbrooke, Can.	1

Total in the United States, 46; in Canada, 3.

Besides these, the Haynes Stellite Co., Kokomo, Ind., operates 3 Snyder furnaces producing stellite; the Chicago Bearing Metal Co., Chicago, operates 2 furnaces producing railroad brass castings, the Bayonne Castings Co., Bayonne, N. J., 1 furnace and the H. Lifchits Brass Foundry & Machine Shop, Indianapolis, 1 furnace.

Besides these, Burn & Co., Calcutta, India, is operating 1 furnace and Mitsui & Co., Japan, are credited with 2 furnaces.

The Industrial Electric Furnace Co. states that all the 49 furnaces in the United States and Canada are making steel castings or ingots.

A newcomer in the field in 1918 was the Vom Baur furnace, which is credited with two more installations in the United States in 1919, or four in all. The Wile furnace has disappeared altogether, so far as can be ascertained, and there is only one Stassano furnace now in existence in either the United States or Canada.

The Ludlum furnace at the plant of the Omaha Structural Steel Works, Omaha, Neb., is not only

Table of the Number of Electric Steel Furnaces in the United States and Canada

Type	U. S., Jan. 1, 1920	Canada, Jan. 1, 1920	U. S. and Canada, Jan. 1, 1920	U. S. and Canada, Jan. 1, 1919	U. S. and Canada, Jan. 1, 1918	U. S. and Canada, Jan. 1, 1917
Heroult	152	18	170	163	146	84
Snyder	46	3	49	48	35	22
Rennerfelt	18	..	18	13	13	13
Greaves-Etchells	17	1	18	11	12	....
Grönwall-Dixon	12	1	13	13	12	9
Ludlum	12	..	12	11	6	5
Girod	5	..	5	5	5	4
Booth	12	..	11	11	4	....
Moore	20	..	20	12	4	....
Induction	3	..	3	3	3	3
Webb	2	..	2	2	2	....
Stassano	1	..	1	1	1	1
Greene	10	1	11	8	1	1
Vom Baur	4	..	4	2	..	....
Wile	..	..	..	..	1	1
Detroit	1	..	1	..	..	....
Special	8	16	24	27	24	12
Total	323	+ 40	=363	330	269	155

making steel castings and low-carbon steel ingots, but is also used for making electric pig iron of which over 200 tons has been produced in the last three months. Besides the 20 Moore furnaces credited to the steel industry, there are two producing carbide and one a brass furnace.

(*Continued on page* 98)

America's Shipbuilding Industry Active

For Private Account, Replacing Government Contracts, 1,200,000 Deadweight Tons Now Under Construction— Emergency Fleet Corporation Builds 6,325,398 Tons in 1919

WITH the shipbuilding program of the Emergency Fleet Corporation, begun in 1916, practically near completion, American shipyards are being filled up with work for private account, and the total deadweight tonnage now under construction in the United States, according to a statement of the Atlantic Coast Shipbuilders' Association, is 1,200,000 tons. The American industry is the only one in the world, the statement says, that is in a position to make quick deliveries of merchant vessels, for the British shipyards are tied up with work for two years.

A recent cable to THE IRON AGE from its London correspondent said that on Oct. 1, 1919, 2,816,000 tons of shipping was under construction in British yards. A statement of the Emergency Fleet Corporation shows that in 1919 there were completed for the Government a total of 1177 ships totalling 6,325,398 deadweight tonnage; of these 748 were steel ships, totalling 4,893,098 deadweight tonnage.

The statement of the Atlantic Coast Shipbuilders' Association by its secretary, Henry C. Hunter, 30 Church Street, New York, says in part:

American shipyards, instead of falling back as Government contracts are suspended, cancelled or completed, are forging steadily ahead. Work for private accounts is replacing that which was being done for the Shipping Board and although a number of orders for American industries have been completed or withdrawn during the past few weeks, the shipyards today are building over a quarter of a million gross tons more than they were a month ago and nearly half a million tons more than in October. The total now under construction, exclusive of all Government work, is 805,000 gross tons, the equivalent of more than 1,200,000 deadweight tons of sea-going vessels.

British Yards Filled Up for Two Years

This steady advance is only one of the encouraging features in the development of the American shipbuilding industry. The shipbuilders, themselves, continue to show faith in the future of the American merchant marine by taking over contracts given up by the Shipping Board and will complete the partially constructed vessels in the expectation of finding a market for them. Conditions indicate that they are justified in the belief that there will be a continued demand for American tonnage.

As matters stand to-day, the United States is the only nation in the world in a position to supply merchant vessels quickly and in quantity. The British shipyards are tied up with orders for two years to come. Other foreign countries are unable to supply the home demand and are seeking tonnage elsewhere. There is nowhere to place orders for prompt delivery but in the United States, and only the unfavorable position of the exchange and the insistence upon long term credits are keeping back a flood of foreign orders. While American tonnage prices are still only about 10 per cent above the British on a basis of currency parity, the high value of the dollar in comparison to the monetary units of other countries, due to the abnormal exchange situation, temporarily imposes upon the buyer of American products a handicap of 20 per cent. As soon as the exchange begins to right itself, however, European shipowners are expected to place contracts in this country.

The factor of speedy delivery is a powerful asset for American shipyards. Leading British shipbuilders who have visited the principal plants in the United States frankly admit that the output here is at the rate of two to three times that of the British yards. This means that, shipway for shipway, this country can produce double to treble the tonnage that Great Britain can. Furthermore, with the great rapidity of turnover, the American shipbuilding industry is getting so much more service out of its plants that this factor will result in a marked lessening of production costs that will enable the United States to meet England's prices, which are at present lower because of cheaper labor.

That speed of production, due largely to the employment of more modern methods and the greater use of labor-saving devices than in Britain, has not lessened the quality of American-built ships, is plainly manifest. Since the Armistice, Lloyd's Register of Shipping, a British institution, has supervised the complete construction of nearly 600 steel steamers in United States yards and has rated every one of them 100-A1, the highest class given.

Only One Ship for Foreign Account

The showing of the American yards is the more remarkable in that of 152 ships now being constructed for private account only one is on foreign order. At present, therefore, American industry is providing practically 100 per cent of the work being done, in spite of the fact that the Shipping Board is trying to dispose of hundreds of completed ships on liberal credit terms.

The total of 805,000 gross tons under construction does not represent all the work American shipbuilders have in hand, for additional contracts which have been placed, but upon which operations have not been begun, will bring the total to more than 1,000,000 tons.

Details of the work actually under way have been prepared from the official classification records of the American Bureau of Shipping and Lloyd's Register. An analysis of these figures shows that the volume of orders has been increasing steadily, both November and December marking increases of about fifty per cent over the previous month, the totals under construction for the three months being: October, 347,343 gross tons; November, 550,714 gross tons; December, 805,147 gross tons.

The rapidly increasing demand for tanker tonnage, due to the recent marked development of the oil-burning ship both here and abroad, is reflected in the returns. Whereas, in October, 160,000 gross tons more of freighters were being built than of tankers, at present the excess of cargo-carrying tonnage under construction is only about 30,000, as the following table covering the various types of tonnage for the past three months shows—(totals in gross tons):

	Oct.	Nov.	Dec.
Freighters	235,523	295,493	400,556
Tankers	74,437	214,940	369,084
Other types	37,383	40,281	35,507
Totals	347,343	550,714	805,147

While the Standard Oil companies lead in the amount of tanker tonnage being built, other interests are securing nearly 250,000 gross tons of the 369,000 total. The distribution is as follows:

	No.	Gross Tons
Standard Oil companies	16	126,195
Atlantic, Gulf & West Indies Steamship Co.	12	89,500
Pan-American Petroleum Co.	9	41,384
Gulf Refining Co.	6	37,828
Standard Transport Co.	5	37,388
Union Oil Co. of California	2	16,000
Vacuum Oil Co.	1	7,150
Sun Oil Co.	1	6,689
Texas Co.	1	3,500
Galena Signal Oil Co.	1	2,500
Nyack Shipbuilding Co.	1	950
Totals	55	369,084

The greatest amount of tonnage is being constructed by the Federal Shipbuilding Co., which has 156,276 gross tons of freighters and 50,000 tons of tankers under way. The Bethlehem Shipbuilding Corporation is next with 144,438 tons of tankers and a 7700-ton freighter.

One of the most encouraging signs of the situation is the increase in the number of yards having private contracts. In October these totaled 27, in November, 31, and the figure has now risen to 38.

Fleet Corporation Has Completed 1757 Ships

In addition to the private contracts which American shipbuilders have taken there remains on the books of a considerable number of them uncompleted contracts which were placed by the Emergency Fleet Corporation. Eighty-five shipyards in the United States, 13 in Japan and one in China are still engaged on Fleet Corporation work, some of which will not be completed until late this year.

In 1919 there were delivered to the Emergency Fleet Corporation 1177 ships of a total deadweight tonnage of 6,325,398, these being divided as follows: Steel, 748 tonnage, 4,893,098; wood, 425, tonnage, 1,418,000; concrete, four, tonnage, 13,500.

The total program of the Emergency Fleet Corporation calls for 2314 ships, of which 1757 have been delivered as follows: In 1917, 49 ships, deadweight tonnage, 302,115; in 1918, 531 ships, deadweight tonnage, 3,021,806; in 1919, 1177 ships, deadweight tonnage, 6,325,398. Keels have been laid for 2266 ships in the four-year period, 1916 to 1919 inclusive, and 2005 ships have been launched.

At the beginning of 1920 about 86 per cent of the total program of the Fleet Corporation is completed. Of the ships yet to be built there are 48 for which keels have not yet been laid; 261 are on the ways; 248 are being outfitted and 1757 are delivered. The total tonnage produced by the Fleet Corporation, when the program is completed, will be 13,628,611. These figures represent all classes of ships. Of the ships for which keels are yet to be laid all are to be of steel. There are 256 steel ships on the ways; 185 are being outfitted and 1207 steel ships have been delivered in the four-year period.

On Jan. 1, 1920, the steel tonnage undelivered will represent 3,816,192 deadweight tons. Since April 1, 1919, deliveries of steel ships have been made at an average rate of 500,000 deadweight tons per month.

Yards Still on Government Work

The shipbuilding companies which are still engaged wholly or partially on Emergency Fleet Corporation work are the following:

Alabama Dry Dock & Shipbuilding Co., Mobile, Ala.
American International Shipbuilding Corporation, Hog Island, Philadelphia.
American Shipbuilding Co., Cleveland, at four yards, Chicago, Cleveland, Detroit and Lorain, Ohio.
Ames Shipbuilding & Dry Dock Co., Seattle, Wash.
Atlantic Corporation, Portsmouth, N. H.
Baltimore Dry Dock & Shipbuilding Co., Baltimore, Md.
Bayles Shipyards, Inc., 290 Broadway, New York.
A. Bentley & Sons Co., Jacksonville, Fla.
Bethlehem Shipbuilding Corporation, South Bethlehem, Pa., yards Alameda, Cal.; Elizabethport, N. J.; Sparrows Point, Md., and Wilmington, Del.
A. C. Brown & Sons, Tottenville, Staten Island, N. Y.
Burger Boat Co., Manitowoc, Wis.
Carolina Shipbuilding Corporation, 415 Broadway, New York.
Chester Shipbuilding Corporation, 1264 Finance Building, Philadelphia.
Coast Shipbuilding Co., 504 Concord Building, Portland, Ore.
William Cramp & Sons Ship & Engine Building Co., Philadelphia.
Oscar Daniels Co., Woolworth Building, New York.
Doullut & Williams Shipbuilding Co., New Orleans, La.
J. F. Duthie & Co., Seattle, Wash.
Federal Shipbuilding Co., Kearney, N. J.
Gibbs Gas Engine Co. of Florida, South Jacksonville, Fla.
Globe Shipbuilding Co., Superior, Wis.
Great Lakes Engineering Works, Detroit; yards at Ashtabula, Ohio and Ecorse, Mich.
Groton Iron Works, 50 Broad Street, New York; yards at Groton, Conn., and Noank, Conn.
Hanlon Dry Dock & Shipbuilding Co., Oakland, Calif.
Johnson Iron Works, New Orleans, La.
Leatham & Smith Towing & Wrecking Co., Sturgeon Bay, Wis.
Fred T. Ley & Co., New York.
Liberty Shipbuilding Co., Wilmington, N. C.; yards at Brunswick, Ga., and at Wilmington.
Long Beach Shipbuilding Co., Long Beach, Calif.
Los Angeles Shipbuilding & Dry Dock Co., San Pedro, Calif.
McDougall-Duluth Co., Duluth, Minn.
Manitowoc Shipbuilding Co., Manitowoc, Wis.
Merchants Shipbuilding Corporation, Harriman, Pa.
Merrill-Stevens Shipbuilding Co., Washington, D. C.
Mobile Shipbuilding Co., Mobile, Ala.
Moore Shipbuilding Co., Oakland, Calif.
Narragansett Shipbuilding Co., Tiverton, R. I.
Nashville Bridge Co., Nashville, Tenn.
Newburgh Shipyards, Inc., Newburgh, N. Y.
Newport News Shipbuilding & Dry Dock Co., Newport News, Va.
New York Shipbuilding Corporation, Camden, N. J.
Northwest Engineering Works, Green Bay, Wis.
Pacific Coast Shipbuilding Co., San Francisco.
Pacific Marine Construction Co. of California, Philadelphia; yard at San Diego, Calif.
Peninsula Shipbuilding Co., Portland, Ore.
Pensacola Shipbuilding Co., Washington, D. C., and Pensacola, Fla.
Providence Engineering Corporation, Providence, R. I.
Pusey & Jones Shipbuilding Co., Philadelphia; yards at Gloucester, N. J., and Wilmington, Del.
George F. Rodgers & Co., Astoria, Ore.
Rolph Shipbuilding Co., San Francisco, Calif.
Russell Shipbuilding Co., Portland, Me.
Saginaw Shipbuilding Co., Saginaw, Mich.
Sandy Point Shipbuilding Co., Sandy Point, Me.
San Francisco Shipbuilding Co., San Francisco.
Seattle North Pacific Shipbuilding Co., Hanover Bldg., New York; yard at Seattle, Wash.
L. H. Shattuck, Inc., Manchester, N. H.
Ship Construction & Trading Co., Stonington, Conn.
Skinner & Eddy Corporation, Seattle, Wash.
Southwestern Shipbuilding Co., East San Pedro, Calif.
Standard Shipbuilding Co., Shooter's Island, N. Y.
Standard Shipyards Co., Wiscasset, Me.
G. M. Standifer Construction Corporation, Vancouver, Wash.
Submarine Boat Corporation, New York.
John W. Sullivan Co., New York.
Sun Shipbuilding Co., Chester, Pa.
Terry Shipbuilding Corporation, Savannah, Ga.
Texas Steamship Co., Bath, Me.
Todd Dry Dock & Construction Corporation, Tacoma, Wash.
Toledo Shipbuilding Co., Toledo, Ohio.
Traylor Shipbuilding Corporation, Cornwells Heights, Pa.
Union Industrial Works, San Francisco, Calif.
Virginia Shipbuilding Corporation, New York.
Western Pipe & Steel Co. of California, San Francisco.
Whitney Bros., Superior, Wis.

The foreign yards which still are engaged on Fleet Corporation contracts are the following:

Asahi, Asahi, Japan.
Asano, Tsurumi, Japan.
Fujinigata, Fujinigata, Japan.
Harima Co., Aioi, Japan.
Ishikawajima, Tokio, Japan.
Kawasaki, Kobe, Japan.
Mitsubishi, Nagasaki, Japan.
Mitsue Bussan, Uno, Okayama, Japan.
Nitta, Osaka, Japan.
Osaka, Osaka, Japan.
Uchida, Kawasaki, Japan.
Uraga, Uraga, Japan.
Yokohama, Yokohama, Japan.
Kiangnan Dock & Engineering Works, Shanghai, China.

Slabbing Mill Motor for Japan

An order for a steel mill electric motor for a large reversing slabbing mill, with a complete set of accessory apparatus, has been placed in this country by the Imperial Steel Works of Japan with the Westinghouse Electric & Mfg. Co., and the order is the second for electrical steel mill equipment to be received by this company from the Imperial Steel Works. It is expected to roll steel ingots weighing up to 25 tons to slabs having a maximum dimension of 17 x 46 in. and a minimum of 4 x 20 in.

The motor will be of 5800 hp. continuous capacity and 17600 hp. momentary. It will have a speed range of 47 to 90 r.p.m. and will use direct current at a voltage of 700. Power for the motor will be furnished by a motor-generator consisting of two 700-volt direct-current generators driven by one alternating-current motor. The generators each will be of 3000 kw. capacity, and will operate at a speed of 368 r.p.m They are to be connected in series with the reversing motor and will be designed to stand the same momentary current peaks that it does. The motor which drives the two generators will be of the 8-pole wound-rotor induction type, and will be of 6250 hp. capacity. It will take 3-phase 25-cycle power at 3300 volts. A 150,000-lb. cast steel flywheel is to be used with this set. It will be composed of three sections and will measure 14 ft. 9 in. in diameter.

To Foster Shop Committee Movement

The National Efficiency Society at the meeting of its board of governors held on Tuesday, Dec. 23, appointed H. F. J. Porter its executive secretary in place of Charles Dexter Allen, of the staff of the *Independent*, who had resigned on account of other duties which prevented his serving longer in that position. Mr. Porter was the founder and executive secretary of the society in 1912 and resigned in 1914 to return to his industrial engineering practice.

In 1918 the Efficiency Society and the National Institute of Efficiency united under the name of the National Efficiency Society with headquarters at 119 West Fortieth Street, New York, and since then the *Independent* has served as its official organ. The society, feeling that the recent movement toward closer cooperation between the employer and employee in industry through sub-committees on which the employee is represented in the management is the logical step towards higher productive efficiency in industry, now so desperately needed, has turned to Mr. Porter, who introduced the shop committee in this country in 1903 and has been identified with the movement ever since. Mr. Porter's office is at 200 Fifth Avenue, New York.

ESTABLISHED 1855

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EDITORS:

A. I. FINDLEY WILLIAM W. MACON GEORGE SMART

CHARLES S. BAUR, *Advertising Manager*

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Looking Into 1920

The things outstanding in the steel market at the opening of 1920 are the unsatisfied demand, output much short of what the steel works are capable of producing, prices rising in the effort of consumers to make sure of their raw materials, and the apportioning of product among buyers after the rationing system which the war made familiar. Other causes have been at work but the conditions stated are due immediately to the steel strike and the coal strike.

Having in mind some sudden reversals of form in other years, leaders in the trade have been searching for signs pointing to a change from existing conditions. Looking at the demand side, the indications are rather for an increase than for a decrease. The program of the automobile industry calls for a considerably larger consumption of steel in 1920 than in the past year. In the matter of building the year has brought an entire reversal of the view held in the early months of 1919 that steel prices above 2 cents would cause the indefinite postponement of large projects. The prospect for building of every character is better to-day than in many months.

As to shipyard work, 1920 is not likely to measure up to 1919. To-day there are indications that the supply of tonnage is overtaking the demands of international trade and the tendency of ocean freights will be downward in the year ahead. Agricultural buying of iron and steel, often exaggerated as a factor in rolling mill operations, may be somewhat less than for the past year if the 1920 crops bear out present reports of lessened acreage.

Exports of American iron and steel have been more in 1919 than was counted on one year ago. They are declining now, partly because our mills are short of steel, in part because rising prices here and falling currency values abroad make American steel too dear in many markets at present freights, also from the natural expectation that production of steel outside of the United States will be larger in 1920 than in the first year after the war.

From the railroads much is expected after three years of minimum buying, and the equipment companies are looking for a greatly enlarged scale of operations. Yet the status of the railroads and their buying power in the coming year are still far from being determined.

The fact that 1919 turned out better in a number of respects for the American steel trade than could be read in the indications at its beginning may be pushed too far as an index of the future. The "work and save" formula that has been urged upon the people from many quarters throughout the year has made little impression, and extravagant expenditure has given continued encouragement to profiteering and to high prices in every line. Having had an experience of so-called war prosperity, many manufacturers, workmen and tradesmen look upon war prices as something to be continued as long as possible. And in that unwillingness to get on any other basis of earnings lies danger for the period just ahead.

The steel trade presents the remarkable aspect of wide variations in the prices paid for semi-finished and finished steel products. The Steel Corporation has asked no higher prices than those which came out of the conference at Washington in March. It has proclaimed widely its opposition to advances, and while the market is recording sales at $5 to $25 per ton, and even more, above the March 21 level, the Steel Corporation is currently selling at the prices it has maintained for more than nine months. It is true that a number of its competitors have yet to deliver a large amount of material at the March 21 prices, and are not taking contracts at the much higher prices represented by scattered transactions. But 1920 is here and their policy as to prices for second quarter delivery must soon be known. It would be entirely without precedent if half the consumers of steel, over any considerable period, were to pay dollars per ton more for their material than the other half. That pig iron has advanced $10 to $12 per ton in less than three months may be taken as pointing the way for steel. This great pig iron advance, while it has been accompanied by a considerable movement, applies to a minor portion of the iron that will be consumed in the next six months. The question may be raised, moreover, whether pig iron prices can go on advancing when the ability of the steel companies to produce pig iron is greater than their ability to produce a corresponding amount of finished material. The labor shortage is more marked

in respect to certain classes of labor at finishing mills. Thus pig iron may tend to accumulate in the hands of steel companies.

The labor situation, so far as better feeling is concerned, has not been improved by the events of the year, and that fact constitutes one of the uncertainties regarding 1920. Another related to it is the injection of labor and Government ownership issues into the coming presidential campaign.

Prophecy may well be restrained, in the face of so many uncertain factors both at home and abroad, but in looking forward to 1920 it will be well for the steel trade to weigh carefully calculations based on the continuance of the present upward movement in prices. How to prevent the indefinite alternation of advances in steel prices and in wages is a paramount issue before the manufacturers and users of steel.

No "Transition Period"

In the late months of the war and for some time afterwards there was much talk of "the transition period." There was no definite list furnished of the things that were to occur in the period, there being simply the general idea that everything would be straightened out, and the whole thing was summed up in the phrase that we should "get on a peace-time basis." The length of the period was estimated at from six months to a year. The transition period was to be followed by a period, of indefinite duration, of regular peace-time activity of a description most satisfactory to everybody.

Fourteen months after the armistice it ought to be easy to recognize this "transitionary" operation, and to say when it ended, or to say that it is still in progress, and then to make a fresh estimate as to when it will end. Nothing of the sort, however, is possible. If we are still in the transition period we are likely to end our lives in it and perhaps leave the remainder as a legacy to our children.

If the period is past, when did it end? Since the armistice there has been only one crucial time, last May. Bradstreet's index number, reflecting commodity prices in general, moved somewhat irregularly after the armistice, but generally in a downward direction until May, when it stood at the lowest point since 1917, except that on March 1 it had been just a shade lower. Since May 1 it has been markedly higher. Another fact that distinguishes May is that it was the month of lowest pig iron and steel production in 1919, except for the dip caused later in the year by the strike.

If one take the six months from the armistice to a time in May as the transition period he obtains a period but very little transition. There is not much reformation about commodity prices and wage rates when they decline only to advance again, yet that is what occurred.

The general idea was that a great deal of work had to be done, work accumulated while the people were busy with the war, and that a "basis" had to be found. The idea that prices had to be deflated to the pre-war level, or anything like it, has of course been exploded and does not need to be discussed. The fault in the general idea was this, that it assumed that the work accumulated was all more or less of the same character, and therefore would all be postponed or stimulated by the same influences. Even if the work were all of the same character it could not all be done at once. If there were three years of it, or five years of it, some would be forced to wait.

Thus it has turned out that immediately after the cessation of hostilities we began some of the peace-time activities, while since then we have begun others, and there are still others that will not begin until some time in 1920.

In view of the fact that even in the first twelve-month after the armistice there were both a decline and an advance in prices, it seems quite reasonable to assume that there will also be declines and advances, or advances and declines, for a period of several years, and that without great changes.

Molybdenum Versus Tungsten

Recent cables from England referring to Prof. John O. Arnold's work on high-speed steels have directed attention again to the value of molybdenum in such steels, but it would appear that no startling discovery has been made.

The use of molybdenum as a substitute for tungsten in high-speed steels has long been known and several years ago was tested out by American and other metallurgists. The preponderating objection has been that, while molybdenum will do the work of about twice the amount of tungsten, the efficiency is only temporary. Molybdenum is a highly volatile metal and continued use and reheating of the high-speed tool cause losses which are disastrous to the structure and effectiveness of the tool.

The only recent announcement of Professor Arnold on this subject is that of last May when he demonstrated the superior efficiency of a molybdenum high-speed steel containing 1.25 per cent of vanadium. His conclusions were based, however, on only a few tests. There was, in fact, very little new in this to American tool steel makers who have been using vanadium in their high-speed steels in increasing amounts for some time. Over 1 per cent vanadium is not at all unusual now. Dr. John A. Mathews made the statement months ago that the use of vanadium was the only new departure in the recent history of high-speed steel metallurgy. The trouble with molybdenum has been and is that regular and reliable results have not been possible thus far, not even with the use of vanadium in all cases. There has also been the marked tendency of chrome-molybdenum steel to crack. Unless Professor Arnold has very recently discovered a new way to prevent this deterioration or sweating of molybdenum high-speed steel, which is doubtful, there is very little cause to fear that British steel makers have outdone their American competitors.

Whether a way can be or has been found to insure the efficiency of a molybdenum high-speed steel, there are several uses to which this metal may be and are now being put which are likely to be of value. Aside from its use as a toughener of light armor plate in conjunction with chromium, nickel and vanadium during the war, its use in small amounts with these metals is promising. Excellent results have been attained from Liberty motor crank-shafts made of these alloying elements

and other applications are revealed where resistance to shock combined with other qualities are necessary. There is also the possibility that molybdenum may displace a certain amount of nickel in some combinations. It is also claimed that greater latitude in heat treatment manipulation is possible in certain combinations with molybdenum.

It is not likely that the commanding position of tungsten high-speed steels has been at all impaired by recent developments. It is probable, however, that as a result of the war new uses for molybdenum and other less familiar alloying elements will rapidly come to light.

Prospects for Railroad Buying

It is not altogether unfortunate that so much time is being consumed by Congress in determining the status the railroads are to occupy in future. It has been the common assumption that if the arrangements were wise and forward-looking the return of the lines to their owners would be followed by a period of important improvement and expansion. In so far as the plans involved might look towards the consumption of steel, however, the present would be an inopportune time for their inception, since the steel industry is in no position to take on additional obligations. Railroad buying at this time would be disturbing rather than beneficial to the steel industry, and thus while the delay may be unfortunate for the railroads, it is not disadvantageous to the steel industry. There has been enough, and too much indeed, of railroad buying when steel was scarce and high priced, with abstention from buying when steel was a particularly good and safe investment. The railroad buying of the past, so often criticized by the sellers of steel, was dictated by conditions in the money market rather than by steel price prospects. It is to be hoped that in the new order of things the flow of capital into railroads will be dictated chiefly by the prospective profitableness of the investment.

Even should an unlimited amount of capital become available for the railroads, something entirely improbable, the railroad managements could not at once embark on a very extensive and comprehensive program, for the preliminaries will consume a great deal of time. The eventual railroad act will be the House or Senate measure or a combination of the two. One requires the consolidation of the railroads into a number of large systems, the other permits this to be done. In either case something of this sort will occur, and plans for improving a railroad system cannot be completed before it is known what parts are to comprise the system.

New principles and standards in railroad improvement will have to be set up, because there are new alignments in cost. If, for instance, the cost of coal has increased 125 per cent, and the cost of labor 175 per cent, it will be less advantageous than formerly to eliminate a grade for the purpose of saving coal. If, on the other hand, the cost of an improved locomotive, which will save a certain amount of labor in moving freight, has increased less than the cost of the labor, then there will be greater reason than formerly to buy that locomotive.

In every direction there are new relations of this sort. In addition, there is an uncertainty as to the continuance of the present standards by which these things are measured. In the past railroad managers could assume that there would be no great fluctuations, in a few years, in the cost of improvements they contemplated. No such assumption can be made now. The prospective cost over a period of years of rails, labor, locomotives, rails and other items will have to be studied very carefully.

Certain improvements and items of upkeep, however, do not require the exercise of foresight. Rails, for instance, are needed and needed at once. Rails have been wearing out and it is quite certain they will continue wearing out in future. Obviously they represent the first important expenditures of the railroads, and rail orders placed and reservations made in the past few weeks show that the beginning has already been made in this direction. Rail orders are by no means unacceptable to the steel industry even now when there is such a shortage of steel in many directions, for the natural alignment in the flow of steel through finishing departments makes it desirable that a certain proportion should pass through the rail mills.

Electric Furnaces in Metallurgy

The world's output of steel and pig iron from electric furnaces has been growing rapidly. Attention has been called at various times to the rapid strides of this or that country in this branch of the steel industry and in almost every case striking figures have been presented. But the real magnitude of the development can only be appreciated by a bird's-eye view of the situation as a whole as presented in THE IRON AGE, Dec. 25, 1919.

Previous to 1913 the steel and pig-iron output of electric furnaces was negligible. In 1913 practically four countries produced 182,400 tons of electric steel. This total grew to more than threefold, or to 549,500 tons, in 1916 and then more than doubled in the next two years, reaching 1,155,000 tons in 1918. In 1913 the eight countries referred to were credited with 121 electric steelmaking furnaces, of which the United States had 233. The United States, Germany, Austria-Hungary and France, which produced the bulk of the electric steel output of 1913, or 182,400 tons, made 844,000 tons or nearly 75 per cent of the total world output in 1918. Not till 1917 did the United States pass Germany as the leading producer. In 1918 American steel makers produced not only nearly 50 per cent of the total world output and 17 times its own 1913 output, but exceeded Germany's output by nearly two and one-half times. France, virtually the home of the electric furnace, is credited with only 58,000 tons in 1918 as against 18,000 tons in 1913 or only a three-fold expansion.

In electric smelting of iron Italy has made the greatest strides. In 1917 that country's electric pig-iron output was 56,500, against only 3800 tons in 1915 or an expansion of 14 fold. The 1918 output was probably as large. Sweden's increase was from 35,000 tons in 1915 to 67,000 tons in 1917. The feature in the industry during the war was the manufacture of synthetic iron or pig iron from steel scrap in electric furnaces, an unusual metallurgical achievement. France is said to have made

at least 150,000 tons in the war period and Canada and the United States made considerable amounts.

While the electric pig-iron industry will probably never attain large proportions, the electric steel industry is a permanent and consequential one. The United States bids fair to lead the world for many years. Germany's output has been running in the past year at about 6000 tons per month as against 18,400 tons per month in 1918 and 8400 tons per month in 1913. Austria-Hungary as a producer will practically disappear. The industry in England and Canada is temporarily on the wane. Conditions in the United States, however, are different and, while the output for 1919 may not reach that of 1918, the number of electric furnaces operating or contracted for in 1919 shows an expansion of about 12 per cent as indicated by the annual review of this industry elsewhere in this issue.

Aside from steel and pig iron, electric furnaces are the vital factor in the production of nearly all the new and the older ferroalloys. And in the non-ferrous industry the crucible is being rapidly replaced by electric melting mediums.

Busy Shipbuilding Plant

The Quincy, Mass., plant of the Bethlehem Shipbuilding Corporation, Ltd., presents a busy scene these days. The corporation has no orders for vessels on foreign contract. It has, however, plenty of work on hand.

It has contracts for eight submarines that amount to something like $1,000,000 each; it has contracts for two scout cruisers to cost in the neighborhood of $17,500,000 each, and for one battleship to cost approximately $25,000,000. This work is all for the Government, has been taken on a cost plus basis, and involves about three and a half years of labor.

In addition, it has five or six freighters on a Shipping Board contract to complete, and two tankers for the Standard Oil Co., in addition to a considerable volume of other work in its final stages of completion.

The corporation's old destroyer ways are being extended sufficiently to permit them taking the keel of the two scout cruisers to be built. One of its old style wooden shops is being torn down to make room for a new modern building, and the management contemplates similar action in the cases of other out-of-date construction.

A contract has been let and work started in a small way on a new large floating dry dock, the contract being placed through New York interests. It will be largely built of wood, although a considerable tonnage of plates and structural material is involved.

English Concern Wants Foundry Equipment

George H. Alexander Machinery, Ltd., 83 and 84 Coleshill Street, Birmingham, England, has written to THE IRON AGE requesting manufacturers of molding machines, riddles and other foundry equipment to send catalogs and full particulars regarding their lines. Equipment will be bought by the Alexander concern to equip a foundry for the manufacture of 70 complete sets of automobile castings per week. The main items are cylinders, which are to be four and six-cylinder monobloc castings in iron; crank cases for same in aluminum; gear boxes, also of aluminum, and sundry parts. The New York Produce Exchange Bank, New York, is given by the English company as reference.

The blast furnace plant at Pont-à-Mousson, Lorraine, was put into operation on Nov. 23 when President Poincaré of the French Republic, after decorating the town of Pont-à-Mousson with the croix de guerre, put the light to one of the five furnaces which were located there. The plant had been badly injured by some 300 bombardments.

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Iron and Steel Markets

UNUSUAL YEAR-END BUYING

Mill Operations Still Restricted by Labor Scarcity

New Pig Iron and Steel Capacity Under Construction Smallest in Nine Years

Iron and steel markets are more active than is common at the opening of a new year, Pittsburgh in particular reporting sustained demand for pig iron, semi-finished steel and finished products. The mills are carrying over large tonnages into 1920—so large in certain lines as to preclude new business for many weeks.

Ordinarily new works under construction are an important factor in the outlook for a new year. To-day, with production so far below capacity, more steel plant would not help. Not since the opening of 1911 have so few new steel furnaces been under construction as are reported by the industry. Our summary shows that 9 new open-hearth furnaces were completed in 1919, capable of producing 625,000 tons a year. Today 22 are under construction, with annual capacity of 875,000 tons. In the four war years beginning Jan. 1, 1915, no less than 14,000,000 tons was added to the country's open-hearth steel capacity by new construction.

Though for several years new pig iron capacity has not been built to keep pace with the increase in steel plant, only two blast furnaces were completed in 1919 and only four, with total annual capacity of 700,000 tons, are now under construction.

With so little prospect of increased output from rolling mills, the expected demand for steel from the railroads raises a problem, as the mills will scarcely put aside orders long on their books to give the railroads the early deliveries many of them will want.

Negotiations over rail purchases, involving all told probably 1,000,000 tons, but at that below normal requirements, have been held up by the extension for two months of Government control. Efforts are now centered in financing the immediate needs of some of the main lines. At Chicago some definite orders have been placed, including 55,000 tons for the Burlington, of which 35,000 tons goes to South Chicago and 20,000 tons to Colorado. The Rock Island is expected to close shortly for 40,000 tons and the Illinois Central for 20,000 tons. Large amounts of track fastenings are wanted, one Western road calling for 17,000 kegs of spikes and 8000 kegs of bolts.

Three definite price scales exist in finished steel lines. The now low scale of March 21, 1919, as consistently maintained (except on some large lots of plates mostly for the Government, which went $3 per ton lower) by the Steel Corporation and in some products by the other large producers, is one; but deliveries against new sales are indefinite. Another is $2 and $3 higher, named by mills slowly returning to a normal operating rate but given sparingly to preferred customers for such mill space as becomes available in the second quarter. The third is the advancing scale which buyers have been willing to pay for large lots for shipment in a number of weeks.

There is a division of sentiment as to the course of prices, represented in the pig iron trade by those who deprecate a further advance, for its consequences in higher wages and higher ore, and, working in the other direction, its effects in higher steel. It is pointed out, however, that with the short supply of labor at finishing mills some of the steel companies will be able for some time to do better as producers of pig iron than as producers of finished product. That would tend to ease the situation in pig iron.

The shortage in semi-finished steel has been emphasized by the shipment of sheet bars from the Chicago district and from Duluth to the Pittsburgh district, where the leading producer had a 95 per cent operation of hot sheet mills early in the week. At Cleveland considerable sales of sheet bars for the first quarter were made at $51 and of slabs at $50.

The pig iron market has shown less activity in some centers, notably New York and Chicago, but buyers have been persistent in other places, especially in the Philadelphia and Pittsburgh districts, in trying to place orders. A leading electrical interest is in the market for 15,000 tons of foundry and malleable for first half, and in Chicago a consumer of basic is inquiring for from 20,000 to 30,000 tons for first half delivery. A very limited tonnage has been sold for third quarter and last half of 1920 at somewhat lower prices than for the first half of the year.

Pittsburgh

PITTSBURGH, Dec. 30.

The holiday season and the close of the year with stock taking, have not had the usual effect of quieting down demand for iron and steel, but, on the contrary, there is a very heavy demand for pig iron, semi-finished steel and finished steel products, very much beyond the ability of producers to meet as fast as wanted. The market is really in the condition that sellers who have anything to sell can readily dispose of it at top prices, it being largely one where it is not a question so much of price but ability of the buyer to get the material. Some grades of pig iron are up fully $1 per ton, while billets and sheet bars would bring close to $50 at mill, if they could be had, but this is impossible. On nearly all kinds of finished steel products, prices fully $5 to $10 per ton higher than the schedule of March 21 can readily be obtained. The activity in demand for this season of the year is very unusual, and is taken by sellers here to indicate that prices will very likely be higher in the new year.

Pig Iron.—There is a very active demand for all grades of pig iron, with prices about $1 per ton higher, and buyers are having a great deal of trouble to find sellers that have any iron to spare. A leading producer of basic that is making 1200 tons per day reports being sold up over first quarter, and has only a limited amount of iron for second quarter. The scarcity in cars and slow delivery of coke have compelled some Valley furnaces to bank, but the situation on Monday was a little better than late last week. We note sales of 3000 to 4000 tons of basic iron at $36, and about the same amount of Bessemer at $37, both at Valley furnace for prompt delivery, with re-

A Comparison of Prices

Advances Over the Previous Week in Heavy Type, Declines in Italics

At date, one week, one month, and one year previous

For Early Delivery

Pig Iron, Per Gross Ton:	Dec. 30, 1919	Dec. 23, 1919	Dec. 2, 1919	Jan. 1, 1919
No. 2 X, Philadelphia‡	**$43.10**	$41.10	$38.10	$36.15
No. 2, Valley furnace†	39.00	39.00	32.50	31.00
No. 2 Southern, Cin'ti†	39.60	39.60	37.60	34.60
No. 2, Birmingham, Ala.†	36.00	36.00	34.00	31.00
No. 2, furnace, Chicago*	40.00	40.00	35.00	31.00
Basic, deliv., eastern Pa.	**39.00**	38.00	32.00	33.90
Basic, Valley, furnace	**36.00**	35.00	33.00	30.00
Bessemer, Pittsburgh	**38.40**	37.40	35.40	33.60
Malleable, Chicago*	40.50	40.50	35.50	31.50
Malleable, Valley	38.00	38.00	33.00	31.50
Gray forge, Pittsburgh	36.40	36.40	33.40	31.40
L. S. charcoal, Chicago	**45.00**	42.50	40.00	38.85
Rails, Billets, etc., Per Gross Ton:				
Bess. rails, heavy, at mill	45.00	45.00	45.00	55.00
O.-h. rails, heavy, at mill	47.00	47.00	47.00	57.00
Bess. billets, Pittsburgh	48.00	48.00	43.00	43.50
O.-h. billets, Pittsburgh	48.00	48.00	43.00	43.50
O.-h. sheet bars, P'gh	50.00	50.00	46.00	47.00
Forging billets, base, P'gh.	60.00	60.00	60.00	60.00
O.-h. billets, Phila.	**59.00**	54.00	48.00	47.30
Wire rods, Pittsburgh	60.00	60.00	58.00	57.00
Finished Iron and Steel, Per Lb. to Large Buyers:	Cents	Cents	Cents	Cents
Iron bars, Philadelphia	3.745	3.745	3.245	3.145
Iron bars, Pittsburgh	3.50	3.50	3.25	2.90
Iron bars, Chicago	**2.90**	2.87	2.77	3.17
Steel bars, Pittsburgh	2.75	2.75	2.75	2.70
Steel bars, New York	3.27	3.27	3.12	2.97
Tank plates, Pittsburgh	2.65	2.65	2.65	3.00
Tank plates, New York	3.02	3.02	2.92	3.27
Beams, etc., Pittsburgh	2.45	2.45	2.45	2.80
Beams, etc., New York	2.82	2.82	2.72	3.07
Skelp, grooved steel, P'gh.	2.45	2.45	2.45	2.70
Skelp, sheared steel, P'gh.	2.65	2.65	2.65	3.00
Steel hoops, Pittsburgh	3.25	3.25	3.25	3.30

Sheets, Nails and Wire Per Lb. to Large Buyers:	Dec. 30, 1919 Cents	Dec. 23, 1919 Cents	Dec. 2, 1919 Cents	Jan. 1, 1919 Cents
Sheets, black, No. 28, P'gh	4.35	4.35	4.35	4.70
Sheets, galv., No. 28, P'gh	5.70	5.70	5.70	6.05
Wire nails, Pittsburgh	4.50	4.50	3.50	3.50
Plain wire, Pittsburgh	3.25	3.25	3.10	3.25
Barbed wire, galv., P'gh.	4.45	4.45	4.25	4.35
Tin plate, 100-lb. box, P'gh	$7.00	$7.00	$7.00	$7.35
Old Material, Per Gross Ton:				
Carwheels, Chicago	$31.00	$31.00	$30.00	$26.00
Carwheels, Philadelphia	30.00	30.00	30.00	25.00
Heavy steel scrap, P'gh.	25.00	25.00	23.00	22.00
Heavy steel scrap, Phila.	22.50	22.50	22.50	18.00
Heavy steel scrap, C'go.	**23.50**	22.00	20.50	19.00
No. 1 cast, Pittsburgh	30.00	30.00	28.00	27.00
No. 1 cast, Philadelphia	**33.00**	32.00	30.00	24.00
No. 1 cast, Ch'go, net ton	33.50	33.50	29.50	25.00
No. 1 RR. wrot, Phila.	31.00	31.00	30.00	25.00
No. 1 RR. wrot. Ch'go, net	24.00	24.00	23.00	21.50
Coke, Connellsville, Per Net Ton at Oven:				
Furnace coke, prompt	$6.00	$6.00	$6.50	$6.00
Furnace coke, future	6.00	6.00	6.00	6.00
Foundry coke, prompt	7.00	7.00	7.00	7.00
Foundry coke, future	7.00	7.00	7.00	7.00
Metals, Per Lb. to Large Buyers:	Cents	Cents	Cents	Cents
Lake copper, New York	**19.50**	19.00	18.75	23.00
Electrolytic copper, N. Y.	**19.25**	18.75	18.25	23.00
Spelter, St. Louis	**9.00**	8.20	8.10	7.65
Spelter, New York	**9.35**	8.55	8.45	8.00
Lead, St. Louis	**7.50**	7.10	6.55	5.70
Lead, New York	**7.75**	7.35	6.75	6.00
Tin, New York	**59.25**	55.50	54.00	71.50
Antimony (Asiatic), N. Y.	9.62½	9.62½	9.25	7.62½

*The average switching charge for delivery to foundries in the Chicago district is 50c. per ton.
†Silicon, 1.75 to 2.25. ‡Silicon, 2.25 to 2.75.

ports that sales have been made of both grades at $1 per ton higher. No. 2 foundry has sold at $39 at Valley furnace and two leading interests are now holding their iron at $40 at furnace. There is a genuine scarcity in supply of iron for early delivery, and the market seems likely to go higher.

The following quotations are all per gross ton at Valley furnaces, freight rate for delivery in the Cleveland and Pittsburgh districts being $1.40 per ton.

Basic	$36.00
Bessemer	37.00
Gray forge	37.00
No. 2 foundry	39.00
No. 3 foundry	38.50
Malleable	38.00

Ferroalloys.—There have been very considerable sales of 78 to 82 per cent domestic ferromanganese at $130 delivered, for shipment in second quarter and also in last half of next year. One dealer has bought about 2000 tons at $130 delivered, and expects to resell it at a considerably higher price. There have been sales of fully 6000 tons for next year delivery of domestic ferromanganese, all at $130 delivered. We also note a sale of 1000 tons of 50 per cent ferrosilicon at $80 delivered, for shipment over all of next year. The leading maker of 50 per cent ferrosilicon at Niagara Falls, N. Y., has sold a very heavy tonnage to consumers in the Pittsburgh district for delivery over all of 1920, at about $80 delivered.

We quote 78 to 82 per cent domestic ferromanganese $130 for second quarter and first half delivered, with a reduction of $1.50 to $1.75 per unit for lower percentages. We quote resale 50 per cent ferrosilicon at $80, and 18 to 22 per cent spiegeleisen at $38 to $40, delivered. Prices on Bessemer ferrosilicon are: 9 per cent, $56.50; 10 per cent, $59.50; 11 per cent, $62.50; 12 per cent, $66.10. We quote 6 per cent silvery iron, $43.75; 7 per cent, $48.00; 8 per cent, $50.00; 9 per cent, $52.00, and 10 per cent, $54.50. An advance of $3.30 per gross ton is charged for each 1 per cent silicon for 11 per cent and over on Bessemer ferrosilicon, and an advance of $2.50 per gross ton is charged for each 1 per cent silicon for 11 per cent and over on silvery iron. All the above prices are f.o.b. maker's furnace, Jackson or New Straitsville, Ohio, which have a uniform freight rate of $2.90 per gross ton for delivery in the Pittsburgh district.

Beams and Channels.—Inquiry for structural steel work is very heavy, and one local interest reports it is figuring now on more work than at any time this year. The American Bridge Co. has taken 700 tons for a new armory in this city, and the McClintic-Marshall Co. has taken 600 tons for an ocean boulevard bridge at Long Beach, Cal., also 800 tons for new buildings for the Mullins Body Corporation, Salem, Ohio; 3500 tons for a sheet mill building for the Republic Iron & Steel Co. at Niles, Ohio; 300 tons for the Philadelphia Paper Co., and 300 tons for new buildings for the Pittsburgh Seamless Tube Co., Economy, Pa.

Beams and channels up to 15 in., 2.45c., Pittsburgh, large lots.

Semi-Finished Steel.—It is said offers of $50 for 4 x 4 in. Bessemer and open-hearth billets have been refused by mills, which state they have no steel to sell at any price. All the sheet and tin plate mills are short of steel, and top prices can be obtained by any seller that has either billets or sheet bars for fairly prompt delivery.

We quote 4 x 4 in. soft Bessemer and open-hearth billets at $48; 2 x 2-in. billets at $48 to $50; slabs, $48; sheet bars, $50, and forging billets, $64 to $66 base, all f.o.b. at mill Pittsburgh or Youngstown.

Plates.—Demand for plates is abnormally heavy and mills are well filled up over the first quarter. The Carnegie Steel Co. is strictly maintaining the March 21 price of 2.65c. on plates, but independent mills are quoting 2.75c. and up to 3c. Local mills at present are figuring on at least 100,000 tons of plates, mostly for shipyards, of this quantity 40,000 tons or more being for tank ships to be built in Seattle yards. As high as 3.25c. is being quoted on plates for early delivery, and it seems very likely the plate market will be on a 3c. basis early in the new year.

Sheared tank plates, ¼-in. and heavier, at 2.65c. to 3c., Pittsburgh, depending on order and delivery.

Sheets.—On Monday the American Sheet & Tin Plate Co. was operating to 95 per cent of its hot sheet mill capacity, but it does not expect to maintain very long this high rate of operation, as it is very short of sheet bars, and is now bringing bars from the Chicago district and also from the Minnesota Steel Co. at Duluth. From the latter mill, the steel is being shipped in cattle cars, and the company is paying a freight rate of about $7.50 per ton for delivery to its mills in the Pittsburgh and nearby districts. This company and most of the leading independent mills are adhering to the March 21 schedule of prices on sheets, but some in-

dependent mills are obtaining a premium of $10 per ton, or more, for first quarter delivery.

We quote No. 28 gage black sheets at 4.35c.; No. 28 galvanized 5.70c., and No. 10 blue annealed, 3.55c., these being the March 21 prices at which the bulk of the tonnage in sheets for first quarter and first half of next year has been sold.

Tin Plate.—On Monday the American Sheet & Tin Plate Co. was operating to 89 per cent of its hot-tin mill capacity, but is very short of steel, and will likely not be able to continue long at this high rate of operation. The output of tin plate for first half of 1920 is all under contract, and some makers are no doubt oversold, as they will carry into next year a very heavy tonnage of tin plate that they were unable to ship out this year, first because of the steel strike, and later the coal strike. There is a scarcity of labor at some tin plate plants, and this is keeping down output. It is likely that output of tin plate to-day is not more than 75 per cent of capacity of the country. For export, mills that will quote are asking $8 per base box, and in some cases $8.50, with considerable sales made at the $8 price. We quote tin plate to domestic consumers for first half at $7 per base box at mill, Pittsburgh.

Wire Products.—In spite of the abnormal demand, the American Steel & Wire Co. is holding firmly to the March 21 prices of $3 per 100 lb. for plain wire, and $3.25 base per keg for wire nails. Most independent mills are quoting $4 and $4.50 for wire nails, and are selling all they care to take without any trouble at these prices. One mill sold recently 5000 kegs of wire nails for first quarter delivery at $4.50 base per keg at mill. We quote wire nails at $3.25 base to $4.50, plain wire 3c. to 3.50c. base, in carloads and larger lots, the lower prices being those of the leading interests.

Wire Rods.—The American Steel & Wire Co. is adhering rigidly to the March 21 price on soft wire rods, which is $52 at mills, gross tons, but other makers are getting $60 and higher. Demand for rods is very active.

Lighter Finished Material.—The demand for the lighter forms of finished steel, such as nuts, bolts and rivets, hot and cold-rolled strip steel, spikes and cold-rolled steel bars, is very active, but most consumers are pretty well covered over first quarter.

Spikes

We quote standard spikes, 9/16 x 4½ in., at $3.35 base per 100 lb. in carload lots of 200 kegs of 200 lb. each, and small spikes, ⅝ in., 7/16 in. and smaller, at $4.25 per 100 lb. in carload lots of 200 kegs of 200 lb. each, plus usual extras. Boat and barge spikes, $4.25 per 100 lb. in carload lots of 200 kegs of 200 lb. each, f.o.b. Pittsburgh. For less than carload lots 1c. per lb. higher is asked.

Cold Rolled Strip Steel

We quote cold rolled steel at $5.65 to $6.00 base per 100 lb. f.o.b. Pittsburgh, for 1½-in. and wider, 0.1000 in. and thicker, hard tempered in coils 0.20 carbon and under. Boxing charge, 25c. per 100 lb.

Iron and Steel Bars.—The Carnegie Steel Co. is adhering to the March 21 price of 2.35c. on steel bars, but other mills are quoting 2.50c. up to 2.75c. and higher. Common iron bars are now held at 3.50c. at mills in carloads and larger lots.

We quote steel bars rolled from billets at 2.75c. and from old steel rails, 3c. Pittsburgh mills rolling iron bars quote, at 3.50c. Pittsburgh, plus full freight rate to point of delivery.

Coke.—The distribution of coal and coke from the mines and oven to consumers by the Railroad Administration has proven very unsatisfactory so far, and some blast furnaces in the two valleys are in distress for coke. There are thousands of cars loaded with coke on track between the ovens and the blast furnaces, but the coke is not being delivered promptly. Some blast furnaces in the valleys have been compelled to bank, waiting for coke to arrive. Ella and Claire of E. W. Mudge & Co. were both banked early this month for lack of coke, and Claire is still banked, but Ella has resumed. The demand for spot furnace coke is heavy with very little offering, producers of coke shipping almost their entire output on contracts. Some contracts for coke made late in November and early December on a five to one basis will soon net the coke producer about $7 a ton for blast furnace coke. There is a great shortage in cars and this is likely to last for some time. It has taken as long as three to four weeks in some cases to move loaded coke cars from the Connellsville region to valley blast furnaces. The output of coke for the week ending Dec. 20 in the upper and lower Connellsville regions was 247,184 tons, the heaviest output in any one week for several months. Government prices are still in effect, these being $6 for spot and future furnace coke, and $7 for spot and future foundry coke, all in net tons at oven.

Old Material.—The local scrap market has quieted down in demand, due to the holiday season, but prices remain very firm, and several local dealers are predicting that heavy steel scrap will go to $30 a ton early in the new year. This is based on the fact that basic iron has sold at $35 at furnace, and dealers claim it should never sell at more than $5 per ton over heavy steel melting scrap. At present the spread between basic iron and heavy steel melting scrap is about $10 a ton. We note sales of 5000 to 6000 tons of heavy steel melting scrap for first quarter delivery at $25 per gross ton delivered to consumers' mills and 2000 to 3000 tons of low phosphorus melting scrap at close to $31 delivered. There is very little activity in borings and turnings and prices are somewhat easier. We quote for delivery to consumers mills in the Pittsburgh and other districts that take Pittsburgh freight rates, as follows:

Heavy steel, melting, Steubenville, Follansbee, Brackenridge, Monessen, Midland and Pittsburgh, delivered	$25.00 to $25.50
No. 1 cast for steel plants	30.00 to 31.00
Rerolling rails, Newark and Cambridge, Ohio; Cumberland, Md.; Franklin, Pa., and Pittsburgh	32.00 to 33.00
Compressed steel	21.00 to 22.00
Bundled sheet sides and ends, f.o.b. consumers' mills, Pittsburgh district	18.00 to 19.00
Bundled steel stamping	16.50 to 17.00
No. 1 busheling	24.00 to 25.00
Railroad grate bars	21.50 to 22.00
Low phosphorus melting stock (bloom and billet ends, heavy plates) ¼ in. and heavier	30.00 to 31.00
Railroad malleable	24.00 to 25.00
Iron car axles	34.00 to 35.00
Locomotive axles, steel	33.00 to 34.00
Steel car axles	31.00 to 32.00
Railroad malleable	24.00 to 25.00
Cast iron wheels	31.00 to 32.00
Rolled steel wheels	27.00 to 28.00
Machine-shop turnings	14.00 to 14.50
Sheet bar, crop ends (at origin)	29.00 to 30.00
Heavy steel axle turnings	20.00 to 21.00
Heavy breakable cast	23.00 to 24.00
Cast iron borings	18.00 to 19.00
No. 1 railroad wrought	27.00 to 28.00

Cleveland

CLEVELAND, Dec. 30.

Iron Ore.—Ore salesmen who recently have made a thorough canvass of the situation by personal calls on consumers believe that ore sales will be heavy the coming season. Mining companies are operating underground mines to capacity and are planning for a large production from open pit mines. It seems pretty well settled in the minds of both consumers and producers that ore prices will be advanced, but it is not expected that the question of prices will be taken up for several weeks. We quote f.o.b. lower Lake ports:

Old range Bessemer, $6.45; old range, non-Bessemer, $5.70; Mesaba Bessemer, $6.20; Mesaba non-Bessemer, $5.55.

Semi-Finished Steel.—There is a heavy demand for semi-finished steel, particularly for sheet bars and slabs, and a local mill is about sold up for the first quarter, making sales at $51 for sheet bars, $50 for slabs, $47.50 for 4 x 4-in. and $51 for 2 x 2-in. billets. Some of the contracts provide for monthly price fixing. Forging billets are selling at $65.

Pig Iron.—There is a considerable inquiry for foundry pig iron in spite of the holiday season. Many foundries in this territory deferred placing contracts or have just come in the market and they are finding it exceedingly difficult to place tonnages, as only one or two sellers can take any additional business. Some furnace interests think prices are high enough and are holding to the $38 price. However, we note the sale of 1000 tons of No. 2 foundry to a Cleveland consumer for the first quarter and a few small lots for prompt shipment at $40, and another 1000-ton sale of off foundry iron at the same basis. Some sellers are far behind on

shipments because of the setback caused by the steel strike and it is expected that the shortage will become more acute in the next few months. We note the sale of 500 tons of 1.75 to 2.25 silicon resale Southern iron for prompt shipment at $37, but only a limited quantity is available. One Alabama interest is quoting $40 for the first half.

Basic	$35.40
Northern No. 2 foundry, silicon 1.75 to 2.25	$38.40 to 40.40
Southern foundry, silicon 2.25 to 2.75	43.45
Gray forge	37.40
Ohio silvery, silicon 8 per cent	52.40
Standard low phos., Valley furnace	$43.00 to 44.00

Finished Iron and Steel.—The shortage in steel is daily becoming more acute and mills able to make any reasonable deliveries are getting higher prices. Plates are selling at 3.25c. and structural material at 2.75c., Pittsburgh or eastern mill. With local warehouse stocks low, there is a heavy demand from this territory on a Chicago warehouse for bars, shapes and nails, the buyer paying the regular warehouse price and freight. This brings nails up to 5.24c., Cleveland. Mills are getting many inquiries for carlots from small consumers who usually place their orders with warehouses. There is a heavy inquiry from fabricators for steel for stock. Hard steel bars are very firm and scarce, some mills quoting a minimum of 3.50c. There is a very heavy inquiry for sheets and some mills are allotting tonnages to their regular trade with prices to be fixed later. The average requirements of sheet consumers are reported to be 20 per cent above the average of this year. Hardware jobbers have advanced sheets $7.60 per ton. Railroads in this territory have made reservations for 10,000 tons of rails. New structural inquiries include 2000 tons for the Sheriff Street market and 600 tons for the East Forty-sixth Street market, Cleveland. Whitehead & Kales have taken 500 tons for a building for the Wadsworth Co., Detroit.

Jobbers quote out of stock: Steel bars, 3.27c. to 3.52c.; plates, 3.57c. to 3.82c.; structural shapes, 3.37c. to 3.62c.; bands and hoops, 3.97c. to 4.27c.; No. 10 blue annealed sheets, 4.47c. to 4.72c.; No. 28 black sheets, 5.27c. to 5.52c.; No. 28 galvanized sheets, 6.62c. to 6.87c.

Old Material.—The market is dull but firm. All grades of scrap are very plentiful except cast and malleable scrap, and dealers generally are not adding to their yard stocks if they can move the material. Some of the mills have large stocks in their yards or under contract, so that not a great deal of activity is expected in January. Malleable scrap, grate bars and stove plate have advanced $1 per ton. Dealers quote per gross ton, delivered:

Heavy melting steel	$21.00 to $21.50
Steel rails, under 3 ft	25.00 to 26.00
Steel rails, rerolling	32.75 to 33.50
Iron rails	29.00 to 30.00
Iron car axles	39.00 to 40.00
Steel car axles	34.00 to 35.00
Low phosphorus melting scrap	23.50 to 24.50
Cast borings	15.00 to 15.50
Iron and steel turnings and drillings	13.00 to 13.50
Short turnings (for blast furnaces)	14.00 to 14.50
Compressed steel	17.75 to 18.00
No. 1 railroad wrought	22.00 to 23.00
Railroad malleable	27.00 to 28.00
Agricultural malleable	22.00 to 23.00
Steel axle turnings	17.00 to 17.50
Light bundled sheet scrap	14.50 to 15.00
No. 1 cast	29.50 to 30.00
No. 1 busheling	20.00 to 21.00
Drop forge flashings, 10 in. and under	18.50 to 19.50
Drop forge flashings, over 10 in	16.50 to 17.00
Railroad grate bars	26.00 to 26.50
Stove plate	26.50 to 27.00

Chicago

CHICAGO, Dec. 30.

Mill operation continues to improve, both the leading interest and the foremost independent now being on an 80 per cent of capacity basis. In the past week the former has blown in three additional furnaces, one each at Gary, South Chicago and Joliet, making a total of 20 active stacks, including one at Milwaukee.

Both pig iron and scrap are suffering a holiday lull, but are nevertheless more active than in this season in normal years.

The demand for steel products is exceptionally heavy and the difficulty in placing business with the mills is more marked than in any year during the last decade, not excepting the war period. Consumers are almost desperate in their efforts to place orders with producers, but are not achieving much success in covering their requirements. In the meantime prices are uncertain. Some mills are taking new business on the basis of prices ruling at the time of shipment, while others are out of the market. There is a growing belief that higher prices will soon crystalize on a level considerably above that of March 21. Exporters and ship builders are bidding prices up and domestic consumers in need of prompt material continue to offer premiums. Bar iron and rail carbon steel mills in this district are resuming operation, but with their books filled for several months ahead they are taking new business sparingly, the lowest quotation on bar iron being 2.90c. Chicago, and on rail carbon bars, 3c. Chicago.

The postponement of the return of the railroads to their owners has caused a further delay in the closing of some Western rail contracts, particularly in those which call for rolling in January and February. One carrier in this class has ordered 15,000 tons of rails to be rolled after March 1, and a like tonnage which will go through the mills in the first two months of the year has been ordered by the Railroad Administration. Other lines prefer to wait until they know definitely under what conditions their properties will be returned under the terms of proposed legislation in Congress, and have postponed action on their requirements. This group of roads includes the Atchison, Topeka & Santa Fe, which has been figuring on 65,000 tons. Among the lines which have definitely closed for their needs is the Chicago, Burlington & Quincy, which ordered 35,000 tons from the Illinois Steel Co. and 20,000 tons from the Colorado Fuel & Iron Co. The Chicago, Rock Island & Pacific and the Illinois Central are expected to close shortly for 40,000 tons and 20,000 tons respectively. Large tonnages of track fastenings are also about to be placed, a typical inquiry from one Western road calling for 17,000 kegs of spikes and 8000 kegs of bolts.

Ferroalloys.—Ferromanganese continues firm at the new price of $130, delivered. The local producer of ferroalloys has resumed operation after being inactive most of the year, and is now employed on eight to 12 per cent ferrosilicon.

We quote 80 per cent ferromanganese at $130 delivered; 50 per cent ferrosilicon at $85 delivered; spiegeleisen 18 to 22 per cent, $40 furnace.

Pig Iron.—The market is less lively than earlier in the month, but is showing more activity than generally obtains during the holiday season. Prompt iron continues to demand a ready sale, and the few furnaces which are quoting for first half delivery are rapidly filling their books. The leading Northern producer continues to sell very sparingly for first and second quarters, but is steadily increasing its output, all of its available stacks now being in operation, and the one which is being repaired scheduled to blow in in about 30 days. The Inland furnace, which was on merchant iron before the steel strike, is being relined, and will be ready to resume early in February. The Southern furnaces have a scarcity of gondola cars, this class of equipment being reserved for coal traffic. One Southern producer has a limited tonnage of foundry to dispose of for first quarter at $36, base Birmingham. Valley stacks are selling foundry at $38 to $40 base, furnace, for first and second quarter delivery, and are asking about the same prices for malleable. An Indianapolis foundry recently closed for 2000 tons of malleable for first half delivery at $38, furnace, and another concern in this district purchased 1000 tons for shipment in the same period at $39.25, f.o.b. Valley. A large basic consumer is in the market for from 20,000 to 30,000 tons for second quarter delivery, one-half for shipment to Western plants and the other half to Eastern points. A Western railroad is inquiring for 2500 tons of foundry and 300 tons of malleable, and a Wisconsin melter wants 1000 tons each of malleable and low silicon foundry. Most charcoal iron furnaces are booked ahead until July 1, and those which are still able to take small additional orders are asking $45,

furnace, for material ranging from 1.40 to 1.50 per cent silicon.

The following quotations are for iron delivered at consumer's yards except those for Northern foundry, malleable and steel-making irons, including low phosphorus, which are f.o.b. furnaces and do not include a switching charge averaging 50c. per ton.

Lake Superior charcoal, average silicon 1.50, f. o. b. furnace, average freight to Chicago, $2.50 (other grades subject to usual differentials)	$45.00
Northern coke foundry, No. 2 silicon, 1.75 to 2.25	40.00
Northern high phosphorus foundry	40.00
Southern coke, No. 1 foundry and No. 1 soft, silicon, 2.75 to 3.25	43.70
Southern coke No. 2 foundry, silicon, 2.25 to 2.75	42.35
Southern foundry, silicon 1.75 to 2.25	41.00
Malleable, not over 2.25 silicon	40.50
Basic	39.00
Low phosphorus (copper free)	45.00
Silvery, 7 per cent	49.15 to 51.80

Plates.—A large local producer recently rejected an order for several thousand tons of plates offered by a Western shipbuilder at 3c., Pittsburgh, and calling for second and third quarter delivery. Both of the leading Western makers are turning away business. A Gulf shipbuilder is inquiring for 360 tons of plates and shapes to be used in the construction of four barges. An inquiry for all-steel box cars for China calls for 134 tons of plates, shapes and bars.

The mill quotation is 2.65c. Pittsburgh, the freight to Chicago being 27c. per 100 lb. Jobbers quote 3.67c. for plates out of stock.

Structural Material.—A number of large fabricating awards are being delayed, it is said, by the shortage of material. Despite this increasing impediment to business, the fabricating field continues active. The Bethlehem Steel Bridge Co. will furnish 3000 tons for the Wrigley Building, Chicago. The Paxton-Vierling Co., Omaha, has the contract for 1500 tons required in the construction of a medical office building in that city. Twelve hundred tons will be supplied by the Omaha Structural Steel Works for the Burgess-Nash Building, Omaha. The Milwaukee Bridge Co. has been awarded 500 tons for the Pekin, Ill., plant of the Corn Products Refining Co. The same fabricator is low bidder on 700 tons for gates and locks for three dams at Wheeling, W. Va. Smaller fabricating awards aggregate about 1200 tons Jobs in prospect include a highway bridge at Prairie-Du-Sac, Wis., involving 550 tons on which the State took bids Dec. 27.

The mill quotation is 2.45c. Pittsburgh, which takes a freight rate of 27c. per 100 lb. for Chicago delivery. Jobbers quote $3.47 for materials out of warehouse.

Bars.—Bar iron has advanced to a minimum of 2.90c., and business taken at this price is largely confined to small orders calling for prompt shipment. All the mills in this district are resuming operation and are well booked ahead. Small lots of rail carbon steel bars continue to sell at 3c., mill, but contracts are taken only on the basis of prices at time of delivery.

Mill prices are: Mild steel bars, 2.85c. to 3.25c., Pittsburgh, taking a freight rate of 27c. per 100 lb.; common bar iron, 2.90c. to 3c., Chicago; rail carbon, 3c. mill. Jobbers quote 3.37c. for steel bars out of warehouse.

Bolts and Nuts.—With material scarce, production continues unsatisfactory.

Jobbers quote: Structural rivets, 4.72c.; boiler rivets, 4.82c.; machine bolts up to ⅞ x 4 in., 35 and 5 per cent off; larger sizes, 25 and 5 off; carriage bolts up to ⅞ x 6 in., 30 off; larger sizes, 20 off; hot pressed nuts, square tapped and hexagon tapped, $1.45 off; coach or lag screws, gimlet points, square heads, 40 and 5 per cent off. Quantity extras are unchanged.

Sheets.—There has been no turn for the better in the sheet market. The leading interest which recently opened its books at the March 21 prices is out of the market.

Mill quotations are 4.35c. for No. 28 black, 3.55c. for No. 10 blue annealed, and 5.70c. for No. 28 galvanized.

Jobbers quote Chicago delivery out of stock; No. 10 blue annealed, 4.57c.; No. 28 black, 5.62c.; No. 28 galv., 6.97c.

Rails and Track Supplies.—The postponement of the return of the railroads to their owners has prevented the closing of a number of rail contracts by Western roads, particularly by those whose programs will vary according to the terms under which their properties revert to their hands. The Atchison, Topeka & Santa Fé, for instance, had been figuring on 65,000 tons, but is now awaiting the outcome of proposed legislation before it decides on its final requirements. Among the lines which have already bought is the Chicago, Burlington & Quincy, which has ordered 35,000 tons from the Illinois Steel Co. and 20,000 tons from the Colorado Fuel & Iron Co. The Illinois Central and Chicago & Rock Island are expected to close for 20,000 and 40,000 tons respectively before the end of the week. Large orders for track fastenings are also in prospect. A typical inquiry calls for 17,000 kegs of spikes and 8000 kegs of bolts. Iron tie plates are no longer obtainable at less than 3.25c., mill.

Standard railroad spikes, 3.35c. Pittsburgh. Track bolts with square nuts, 4.35c. Pittsburgh. Steel tie plates and iron angle bars, 2.75c. Pittsburgh and Chicago; tie plates, iron, 3.25c. f.o.b. makers' mills. Light rails, 2.45c. f.o.b. makers' mills, with usual extras.

Wire Products.—With the leading interest practically out of the market for the present, wire products are selling at considerably above the March 21 prices. Wire nails, for which the foremost producer has been asking $3.25 per keg, have been selling commonly at $4.50, and in some instances consumers have offered as high as $6. Nail production is not recovering as fast as that of some other products because of a shortage of nail machine operatives. It is felt in some quarters that the policy of holding to the Redfield prices was a mistake, inasmuch as it deterred many independent interests from manufacturing wire products as extensively as their capacity warranted. This factor, together with the curtailment of output on account of the steel strike has brought about a very low available supply for spring needs. For mill prices see finished iron and steel, Pittsburgh, page 95.

Cast-Iron Pipe.—Detroit will ask bids on 9200 tons to-day. Rio, Wis., will receive tenders on 170 tons,

We quote per net ton, f. o. b. Chicago, ex-war tax, as follows: Water pipe, 4-in., $69.80; 6-in. and above, $66.80; class A and gas pipe, $2 extra.

Old Material.—The market is less lively than earlier in the month but more active than is generally the case in the holiday season. Ordinarily there is little buying by consumers from the middle of December until the first of March, but owing to the postponement of purchases during the steel and coal strikes, dealers anticipate sustained activity throughout the early months of the year. Prices have advanced in a number of grades but not as generally as a week ago. A Peoria steel interest recently bought 10,000 tons of heavy melting for which it is understood to have paid $24.50 per gross ton. The Burlington advertises a list of 3500 tons and the Grand Trunk 1200 tons. The International Harvester Co. is receiving tenders on its output of scrap during the first quarter, estimated at about 15,000 tons.

We quote delivery in buyer's yards, Chicago and vicinity, all freight and transfer charges paid, as follows:

Per Gross Ton	
Iron rails	$28.00 to $29.00
Relaying rails	40.00 to 50.00
Car wheels	31.00 to 32.00
Steel rails, rerolling	32.50 to 33.50
Steel rails, less than 3 ft	28.00 to 28.50
Heavy melting steel	23.50 to 24.50
Frogs, switches and guards, cut apart	22.00 to 23.00
Shoveling steel	23.00 to 23.50
Per Net Ton	
Iron angles and splice bars	$28.50 to $29.50
Steel angle bars	24.00 to 24.50
Iron arch bars and transoms	29.25 to 30.25
Iron car axles	34.00 to 35.00
Steel car axles	30.00 to 30.50
No. 1 busheling	20.50 to 21.00
No. 2 busheling	13.50 to 14.00
Cut forge	22.50 to 23.00
Pipes and flues	18.50 to 19.00
No. 1 railroad wrought	24.00 to 25.00
No. 2 railroad wrought	22.00 to 22.50
Steel knuckles and couplers	23.50 to 24.00
Coil springs	23.50 to 24.00
No. 1 cast	33.50 to 34.00
Boiler punchings	24.50 to 25.00
Locomotive tires, smooth	21.50 to 22.00
Machine-shop turnings	10.50 to 11.00
Cast borings	12.50 to 13.50
Stove plate	27.00 to 28.00
Grate bars	27.25 to 28.25
Brake shoes	22.50 to 23.50
Railroad malleable	25.00 to 26.00
Agricultural malleable	26.00 to 27.00
Country mixed	17.50 to 18.50

Philadelphia

PHILADELPHIA, Dec. 30.

While the desire of the steel trade is to prevent, if possible, a runaway market, the actual facts are that selling prices of various products are constantly creeping upward on such lots as are to be had for nearby shipment. A small lot of structural shapes was sold at 2.75c., Pittsburgh, while bar sizes have brought 3c. Soft steel bars have sold at 3.50c., Pittsburgh, and forging bars at 3.75c. Plates are now generally on the basis of 3c. to 3.25c., Pittsburgh, with the exception of such selected lots as the leading interest is taking at 2.65c. Open-hearth rerolling billets have been sold by at least two eastern makers at $55, Pittsburgh, an advance of $5, and forging billets have brought $65 and $67.50, Pittsburgh, on various transactions. Sheets are scarcely to be had at any price for first quarter delivery and the same applies to wire products and pipe.

Pig iron continues to advance on a moderate amount of buying. Higher prices are noted on transactions the past week on basic and standard low phosphorus iron and on foundry grades, eastern Pennsylvania No. 2 X having been sold at $42, furnace.

Large railroad buying now looms as a certainty. In fact, purchasing departments of Eastern roads have already begun to inquire and have advised the trade that there will be extensive buying in 1920 and that financial arrangements are sure to be made now that the date for the return of the roads to their owners has been fixed as March 1. The Chicago, Burlington & Quincy Railroad has inquired for 5000 tons of plates. Pacific Coast shipbuilders have inquired for 15,000 tons of plates, in addition to 75,000 from two Western yards mentioned last week.

The General Electric Co., Schenectady, N. Y., is in the market for 15,000 tons of foundry and malleable pig iron for second quarter.

Pig Iron.—The year closes with still higher prices paid for various grades of pig iron. Two or three lots of basic, the largest about 2000 tons, have been sold at prices ranging from $39 to $40, delivered, and gray forge has been sold in fairly large tonnages to an Eastern puddling plant at about $38.50 and $39, furnace. Standard low phosphorus iron on recent sales has advanced $1 a ton to $46, furnace, but copper free iron is still quoted at $40, furnace. The demand for foundry iron is not so large nor so insistent, but prices have advanced still further, $42, furnace, having been paid on several transactions in eastern Pennsylvania No. 2 X, 2.25 to 2.75 per cent silicon. A western Pennsylvania furnace sold 1000 tons of No. 2 X for delivery in this district at $41, furnace, plus a freight rate of $2.80. Higher silicon iron has commanded figures up to $44 and $45, furnace. Virginia furnaces which are in the market are selling on the basis of $40, furnace, for 1.75 to 2.25 per cent silicon iron and $41.25 for 2.25 to 2.75 per cent silicon iron. One seller disposed of 1000 tons on this basis. The question as to selling for second and third quarter is now being seriously considered by some furnace operators, a few of whom believe that it is safe to sell for that delivery at prices now quoted for first quarter. There are others who believe that foundry iron prices will go higher, $50 being talked of as a possibility. The Eastern pig iron trade does not entertain hope of any substantial increase in iron production during the winter months, fuel and car shortage complicating the situation at the present writing. The General Electric Co. has an inquiry out for 15,000 tons of foundry and malleable grades for second quarter delivery at its Eastern plants.

The following quotations are for iron delivered in consumers' yards in Philadelphia or vicinity, except those for low phosphorus iron, which are f.o.b. furnace:

Eastern Penn., No. 2X, 2.25 to 2.75 sil.	$43.10 to $43.80
Eastern Penn., No. 2 plain, 1.75 to 2.25 sil.	42.10 to 42.80
Virginia No. 2 X, 2.25 to 2.75 sil.	45.35
Virginia No. 2 plain, 1.75 to 2.25 sil.	44.10
Basic deliv. Easton, Pa.	39.00 to 40.00
Gray forge	39.40
Standard low phosphorus (f.o.b. furnace)	46.00
Malleable	38.60 to 39.60
Copper bearing low phosphorus (f.o.b. furnace)	40.00

Ferroalloys.—The leading domestic maker of ferromanganese has withdrawn from the market for first half, selling only for third quarter at $130, delivered. The last sales for second quarter were made on the basis of $130, delivered, for alloy analyzing 76 to 80 per cent, the lower percentage of manganese being stipulated because of the necessity of using stocks of low-grade ore. One British agent has about 500 tons of ferromanganese for delivery in second quarter at $130, seaboard. Spiegeleisen is quoted at about $40, furnace.

Semi-Finished Steel.—Sales of open-hearth rerolling billets have been made by two Eastern makers at $55, Pittsburgh. Forging billets have been sold at $65 to $67.50, Pittsburgh, with $70 being asked by one maker. We quote open-hearth rerolling billets at $59, Philadelphia.

Plates.—The demand for plates continues unabated. Considerable ship tonnage from the Pacific Coast is offered, two new inquiries being for 7500 tons each, one from the Northwest Steel Co., Portland, Ore., and the other from the Western Pipe & Steel Co., San Francisco. These shipbuilding companies desire to place the tonnages with Eastern mills so as to obtain the advantage of the lower water freight rate. The Chicago, Burlington & Quincy Railroad has inquired here for 5000 tons of plates and smaller inquiries from Eastern roads are also in the market. Some of the steel companies have received official advices from purchasing departments of the railroads that there will be considerable buying of plates, shapes, bars, etc., for 1920 delivery with the supplementary information that financial arrangements for such purchases will be made before the return of the roads to their owners on March 1. Although the leading interest is reported to be accepting selected tonnages of plates at 2.65c. it is impossible to buy at this price from independent steel companies, practically all of which are quoting 3c. to 3.25c., Pittsburgh. We quote sheared plates, ¼ in. and heavier, at 3.245c., Philadelphia.

Structural Material.—Evidences of a large building program for 1920 are at hand. Last week one Eastern company turned down an aggregate of about 10,000 tons of structural shapes because its order book is already so well filled. While it is possible to obtain fairly good delivery of structural sizes from some of the Eastern mills, it is difficult to obtain bar sizes. As high as 3c., Pittsburgh, has been obtained for bar size shapes, while structural shapes have sold at from 2.55c. to 2.75c., Pittsburgh. A Virginia fabricator has taken a 3000-ton order for an office building in Dallas, Texas. We quote plain material at 2.795c., Philadelphia.

Bars.—Steel bars are still difficult to get, with the tendency toward higher prices. One Eastern company has obtained 3.50c., Pittsburgh, for rerolling quality and 3.75c., Pittsburgh, for forging quality. Some mills which have none to sell for early delivery are quoting a nominal price of 3c. Bar iron remains at 3.50c., Pittsburgh with a very fair business being done.

Sheets.—It will apparently be some months before the shortage of sheets is relieved. Sheets for early delivery from mill are apparently not to be had anywhere and stocks in the hands of merchants are bringing fancy prices. A local mill rolling blue annealed sheets only is quoting 4.05c. Pittsburgh, for No. 10 gage, but is unable to promise delivery in first quarter.

Wire Products.—The shortage of wire nails has become so acute that it was impossible to complete a grandstand on which work had been begun in Philadelphia because a sufficient quantity of nails could not be obtained.

Old Material.—Although the last week of the year did not produce much new business in scrap, prices remain very firm and dealers are expecting a better business and higher prices in January. It is the prediction of the scrap trade that the Pittsburgh mills will come into the market within a few weeks and that they will be forced to pay $25 to $26 or higher for No. 1 heavy melting steel. One offer of $25.50, delivered, has already been heard. Eastern foundries are using very

large quantities of scrap on account of the shortage of pig iron, and the result has been a steadily advancing market for No. 1 cast, which has now reached $33 to $34, sales of small lots having been made the past week at the higher figure. We quote for delivery at consumers' works, eastern Pennsylvania, as follows:

No. 1 heavy melting steel	$22.50 to $23.50
Steel rails rerolling	32.00 to 34.00
No. 1 low phosphorus, heavy, 0.04 and under	27.00 to 28.00
Car wheels	30.00 to 31.00
No. 1 railroad wrought	31.00 to 32.00
No. 1 yard wrought	25.00 to 26.00
No. 1 forge fire	18.50 to 19.00
Bundled skeleton	18.50 to 19.00
No. 1 busheling	20.00 to 21.00
No. 2 busheling	16.50 to 17.50
Turnings (short shoveling grade for blast furnace use)	17.50 to 18.00
Mixed borings and turnings (for blast furnace use)	17.25 to 17.75
Machine-shop turnings (for rolling mill and steel works use)	18.50 to 19.00
Heavy axle turnings (or equivalent)	20.00 to 21.00
Cast borings (for rolling mills)	22.00 to 23.00
Cast borings (for chemical plant use)	24.50 to 25.00
No. 1 cast	33.00 to 34.00
Railroad grate bars	26.00 to 27.00
Stove plate	22.50 to 23.50
Railroad malleable	27.00 to 28.00
Wrought iron and soft steel pipes and tubes (new specifications)	22.00 to 23.00
Ungraded pipe	17.00 to 18.00
Iron car axles	45.00 to 46.00
Steel car axles (f.a.s. New York for export)	35.00 to 38.00

Cincinnati

CINCINNATI, Dec. 30.

Pig Iron.—There has been a slackening of inquiry for pig iron in the market during the past week, accounted for in part by the holiday season, but chiefly to the fact that consumers have realized that there is very little to be had. Some small sales are reported, chiefly in 100-ton lots, but these have generally been to regular customers who found themselves in need of a little extra tonnage. The fuel situation, which is very acute in the opinion of dealers here, is bound to have an effect on the iron situation. The blowing in of a number of stacks which had been planned for Jan. 1 has had to be postponed on account of the coke shortage, and it is possible that some of those now operating will be forced to bank within the next week if conditions do not improve. The scarcity of cars is very pronounced, and should the condition become worse the situation will be very serious. Prices are very firm, with a tendency to go higher. Some sales of Southern iron were reported by one interest last week, mostly in small lots at $37, Birmingham, and southern Ohio iron has in one instance brought as high as $40, furnace, for prompt shipment. Furnace interests are not contracting for future delivery, as they are practically sold up for first quarter, and are waiting till after New Year to get an idea of their operating costs before opening their books. One sale of 3000 tons of charcoal iron was reported in this territory last week, price not given, and a fair tonnage of malleable was also taken. An inquiry for 5000 tons of No. 2 foundry iron for first half delivery from a consumer in this territory has been received and another for 500 tons, but no quotations have been made, as furnaces report the iron is not available and that it will be well into the new year before the situation clears up sufficiently to enable them to chart their future course.

Based on freight rates of $3.60 from Birmingham and $1.80 from Ironton, we quote f.o.b. Cincinnati:

Southern coke, silicon 1.75 to 2.25 (base price)	$39.60 to 40.60
Southern coke, sil. 2.25 to 2.75 (No. 2 soft)	41.00
Ohio silvery, 8 per cent silicon	51.80
Southern Ohio coke, silicon 1.75 to 2.25 (No. 2)	39.55
Basic, Northern	36.05
Malleable	40.05

Finished Material.—The demand for finished steel is very heavy. Most of the mills in this territory are completely booked for the first quarter, and show no desire to take on business beyond that period. Prices are very firm, and in some cases premiums are offered for prompt delivery.

Old Material.—The scrap market during the past week has been fairly active, though the holidays tended to make business a little quieter than usual. With the high prices asked, foundry men are not at all anxious to buy, preferring to wait till after the new year to see what it will bring forth. As high as $34 was paid by one consumer for No. 1 machinery cast, but he needed it very badly and was forced to pay for it. Dealers were asking $34.50 for the same material at the close of the week, but there were no sales reported at this figure. Cast borings have been in good demand, and the price has been marked up $1 a ton during the week, being now quoted at $12.50 to $13. Prices on other grades are practically the same as last week, but the dealers expect that they will go higher, as they are being forced to pay higher prices for their material. That there is some justification for this contention is the fact that one interest, which disposes of a large tonnage to dealers in this territory, has recently sold a block of scrap at prices far above the market. This was not for consumption in this vicinity, however. The general trend of prices is upward, in keeping with the advances being made in pig iron. Where it will end is a question, but competent observers look for something definite before long.

Per Gross Ton

Bundler sheet	$15.00 to $16.00
Old iron rails	26.00 to 27.00
Relaying rails, 50 lb. and up	42.00 to 43.00
Rerolling steel rails	26.00 to 27.00
Heavy melting steel	20.00 to 21.00
Steel rails for melting	22.00 to 23.00
Old car wheels	24.00 to 25.00
No. 1 railroad wrought	21.00 to 22.00

Per Net Ton

Cast borings	$11.50 to $12.00
Steel turnings	11.00 to 11.50
Railroad cast	27.00 to 28.00
No. 1 machinery	30.00 to 31.00
Burnt scrap	17.00 to 18.00
Iron axles	28.50 to 29.00
Locomotive tires (smooth inside)	21.50 to 22.50
Pipes and flues	16.00 to 16.50
Malleable cast	19.50 to 20.00
Railroad tank and sheet	15 00.to 15.50

Birmingham

BIRMINGHAM, ALA., Dec. 30.

Pig Iron.—The Birmingham iron market at the close of Christmas week was marking time with an absolute minimum of $36 for 1.75 to 2.25 silicon, little business going, none sought, and an inclination on the part of makers to go slowly a while in marking up. The $36 minimum, however, was on weak legs, more than one interest having advanced to $37, at which the market will probably establish a new minimum before the week ends. A few Southern consumers who insisted on prompt iron were accommodated by one concern at $37.50. Makers look forward to $40 as the probable high limit, but will not hurry it. Considering the pressure of the buyer, the seller has been conservative. Southern makers do not wish to spoil a good thing. All wage troubles were over on the incoming of the holidays and the only problem ahead was greater production to meet the demand. The Tennessee company finds itself in a strong position by the blowing in of 77 of its new by-product ovens at Fairfield, giving it 5000 tons more of by-product coke per diem. The other 77 will be blown in shortly. We quote per gross ton, f.o.b. Birmingham district furnaces, as follows:

Foundry, silicon	$36.00
Basic	35.00

Old Material.—The scrap market remains considerably stronger than it was for a number of months. Dealers who held out for the higher prices have shown their wisdom. Both scrap and steel are moving in large quantities and stocks are running low A lot of scrap is used in place of pig iron. We quote per gross ton, f.o.b. Birmingham district yards, prices to consumers, as follows:

Steel rails	$21.00 to $22.50
No. 1 heavy steel	20.00 to 21.00
Cast iron borings	14.00 to 15.00
Machine-shop turnings	14.00 to 15.00
Stove plate	24.00 to 25.00
No. 1 cast	26.50 to 27.50
Car wheels	26.50 to 27.50
Tramcar wheels	25.50 to 26.50
Steel axles	29.00 to 30.00
No. 1 wrought	24.00 to 25.00

Buffalo

BUFFALO, Dec. 30.

Pig Iron.—Inquiries continue to be numerous, for first half iron, particularly for second quarter, with considerable volume for third quarter, and some for fourth quarter. A good many users are endeavoring to secure supplies as far into next year as possible. Inquiries are coming in from Ohio, Michigan and other centers outside this district, notwithstanding the higher freight rate for long distance points. Immediate delivery iron is impossible to obtain. Even the producer that has until recently been able to supply spot iron in small quantities is now sold out for some time ahead. Some furnaces are not quoting at all for third quarter. A good many foundries are in bad shape for iron, and some have been obliged to shut down temporarily and others to curtail output sharply. The furnace that has had untaken capacity to offer has sold considerable tonnage for the latter part of the first half during the week and has quotations out for 10,000 to 15,000 tons, foundry grades for second and third quarters and is standing strictly by $40 base, for 1.75 to 2.25 silicon and selling nothing under that price, $41.25 for 2.25 to 2.75 silicon and $43 for 2.75 to 3.25. We quote as follows, f.o.b. furnace, Buffalo, malleable quotations being nominal, as there is none for sale:

No. 1 foundry, 2.75 to 3.25 silicon	$43.00
No. 2 X, 2.25 to 2.75 silicon	41.25
No. 2 plain foundry, 1.75 to 2.25 sil	40.00
Malleable, silicon not over 2.25	39.25
Basic	38.00
Lake Superior charcoal, regular grades, f.o.b. Buffalo	42.60

Old Material.—It looks like a very strong market as soon as the present holiday lull in buying is over, and dealers have been inclined to hold stocks until after the first of the year, when higher prices on all commodities are expected. There is a strong demand for heavy melting steel, machine shop turnings and cast borings, indicating that prices on these commodities will advance materially. The price current for heavy melting for local delivery has been $23 to $23.50, but outside district offers of $25 have been made by brokers and sales have been made in the Valley district for January and February delivery at $26, delivered. Machine shop turnings have tightened up to $14.50 to $15, and it is very difficult to buy more than a small tonnage of any commodity at present prices. Local mills are now in very good shape, being rid of their handicaps on account of the strike and coal shortage, and having conditions favorable to full operation of plants. We quote as follows, per gross ton, f.o.b. Buffalo:

Heavy melting steel, regular grades	$23.00 to $23.50
Low phosphorus, 0.04 and under	27.00 to 28.00
No. 1 railroad wrought	28.00 to 29.00
No. 1 machinery cast	30.00 to 31.00
Iron axles	35.00
Steel axles	35.00
Car wheels	32.00 to 33.00
Railroad malleable	24.00 to 25.00
Machine-shop turnings	14.50 to 15.00
Heavy axle turnings	19.50 to 20.00
Clean cast borings	20.00 to 21.00
Iron rails	28.00 to 29.00
Locomotive grate bars	22.50 to 23.00
Stove plate	24.00 to 24.50
Wrought pipe	19.00 to 20.00
No. 1 busheling	20.00 to 21.00
Bundled sheet stamping	16.00 to 17.00

Finished Iron and Steel.—More and more pressure to obtain tonnage is noted in all lines of finished products. The policy of the independent mills as to the acceptance of tonnage is becoming more clearly defined and the prices quoted are based upon each producer's individual views and conditions, so that the prices are varying from the so-called official basis of March 21, which is being followed by all Steel Corporation subsidiaries, to those established by some of the smaller independents, and being from 10c. to 20c. per 100 lb. above the so-called official prices. The building prospects in Canada are extremely bright for 1920, many large projects being under consideration, and fabricating shops are practically booked in full for a number of months. The Bureau of Building, Buffalo, has issued permit to William J. Conners, proprietor of the Buffalo *Courier and Enquirer*, to erect a 32-story newspaper and office building at a cost of $1,500,000, and bids for a large tonnage of structural steel will soon be taken.

New York

NEW YORK, Dec. 30.

Pig Iron.—This is the second week in succession in which the market has seen no advance in price, indicating that the upward trend has been at least temporarily checked. In fact, it is rumored about New York that in the Buffalo district the market has weakened slightly. One New York seller has sold 1000 tons of foundry iron for the last half of next year, which is perhaps the first sale of note for this delivery. The price in this transaction was slightly lower than current quotations. An eastern Pennsylvania furnace which has sold 30,000 tons for last half at from $40 to $42, furnace, for iron, silicon 2.25 to 2.75, has now withdrawn from the market. The General Electric Co. has sent out an inquiry for 20,000 tons of foundry iron for that delivery next year for which it may receive the most favorable price, the supply to be distributed among its various plants. A pump and equipment maker is asking for 1600 tons of foundry iron for second quarter. Iron with silicon 2.25 to 2.75 has been selling in several instances at around $41, furnace, though sales have been made recently at as high as $43 for this grade. Because of the many furnaces down for repairs, the shortage of cars for transporting coke, the mounting costs of labor, and other factors, the majority of sellers are predicting no lowering of present prices, at least through the first half of next year.

No. 1 foundry, silicon 2.75 to 3.25	$42.80 to $43.80
No. 2X, silicon 2.25 to 2.75	41.80 to 42.80
No. 2 plain, silicon 1.75 to 2.25	40.80 to 41.80
No. 2X, Virginia, silicon 2.25 to 2.75	43.40

Finished Iron and Steel.—Mills are returning to normal production very slowly, with the result that even less material can be bought for second quarter than seemed likely a week ago. Statements are made officially that the Steel Corporation will not advance its prices and thus the market really has three levels: one for more or less indefinite delivery, as from the Steel Corporation; the highest prices, for business taken for relatively early delivery by mills which find mill space available; and an intermediate price level corresponding to such second quarter business as may be taken by the larger companies which have been doing little in the last few months. Negotiations with the different railroad corporations for rails have been held up with the postponement of the railroad ownership decision, but efforts are still being made to secure limited deliveries in January and February. The general steel scarcity is indicated by the sale of about 50 tons of odds and ends of billets at $45, Pittsburgh base; of about 200 tons of so-called bone yard plates at $36 per gross ton; the refusal of a mill, recently selling, to take on 2000 tons of ship plates for a nearby yard which offered 3.25c., Pittsburgh, for January and February delivery. Universal plates for the next two months are moving at 3c. Tin plates have sold at $8.25 per box and $8.50 has been offered. Fabricated steel bids have been asked on the following: Power house, Warren, Ohio, 400 tons; two pier sheds, New York, each 300 tons, and a coal breaker at Scranton for the Lackawanna Railroad, 1200 tons. Bids have been taken by the Government for three cranes, two at Norfolk and one at Philadelphia, 400 tons.

We quote for mill shipment, New York, as follows: Soft steel bars 2.62c. to 3.27c.; shapes, 2.72c. to 2.82c.; plates, 2.92 to 3.27c.; the minimum prices being for indefinite delivery and the higher prices for the first quarter; bar iron, flats, wider than 6 in., 4.07c.; ⅜ and 7/16 in. round and square, 4.47c., light rounds, squares and flats, 4.77c., and other sizes, 3.77c.

Ferroalloys.—The ferromanganese market is active and exceedingly strong. In the last few days 5000 to 6000 tons, comprising both domestic and British alloy, has been sold. From 4000 to 5000 tons of this has been domestic alloy, 78 to 82 per cent, for which $130, delivered, was realized. About 1200 tons of British alloy, 76 to 80 per cent, has been sold at $125, seaboard, for delivery in the second quarter. A representative of another British producer has sold 1000 tons at $120, seaboard, for second quarter delivery. There is practically no British alloy at present before the market for de-

livery in the first half, but it is understood that one British producer has some to offer for third quarter at $130, seaboard. There is practically no domestic alloy available for delivery in the first half with the exception of a small amount which it is understood one maker has not yet sold. The spiegeleisen market is quiet but very strong at $40 to $45, furnace. A sale of 2500 tons of 19 to 21 per cent alloy is reported for foreign consumption, but the destination and price are not revealed. It is generally acknowledged that supplies of manganese ore for domestic producers outside of the leading interest are scarce. While some sales of foreign ore are reported at 55c. per unit, it is understood that domestic users are willing to pay 60c. Ferrosilicon, 50 per cent, is strong but quiet at $80 to $90 delivered. It is reported but not confirmed that the leading consumer has recently contracted for 12,000 tons for 1920 consumption. Quotations for ferrotungsten are nominal at $1 to $1.10 per lb. of contained tungsten, with transactions probably a matter of negotiation for open market quotations are hard to ascertain. Ferrochromium, 60 to 70 per cent, carload lots, is quoted at 20c. to 21c. per lb. of contained chromium, with the carbon ranging from 6 to 8 per cent. For less than carload lots 1c. per lb. higher is asked, and for the alloy in which the carbon ranges from 4 to 6 per cent an increase of 1c. per lb. over the foregoing values is the rule. Sales of ferrovanadium have been made at as high as $6 per lb. of contained vanadium in wholesale lots for early delivery. Ferrocarbontitanium, 15 to 18 per cent, is selling at $200 per net ton in carload lots, at $220 per ton in lots between one ton and a carload, and at $250 per ton in lots less than a ton, f.o.b. Suspension Bridge, N. Y.

Old Material.—As is the case with pig iron, the march upward of prices has received a check, temporary at least, though optimism for the future prevails. Steel car axles, for which there was a sudden keen demand a few weeks ago, have again advanced about $1 in a week. Because of the scarcity of pig iron, cast scrap is still in big demand and in many instances commands higher prices than quoted here. A New York broker who issues each week a typewritten list of prices which his buyers must not exceed, and who has been continually revising these prices upward each week for the past six weeks, has this week lowered some of his prices, which is one indication of the static market. Prices which dealers and brokers are paying, New York, per gross ton, follow:

Heavy melting steel	$19.50 to $20.50
Rerolling rails	29.00 to 30.00
Relaying rails, nominal	47.00 to 48.00
Steel car axles	31.00 to 32.00
Iron car axles	40.00 to 41.00
No. 1 railroad wrought	28.00 to 29.00
Wrought iron track	20.00 to 20.50
Forge fire	16.50 to 17.00
No. 1 yard wrought, long	22.00 to 23.00
Light iron	7.00 to 8.00
Cast borings (clean)	17.00 to 17.50
Machine-shop turnings	15.00 to 15.50
Mixed borings and turnings	14.00 to 14.50
Iron and steel pipe (1 in. min. diam., not under 2 ft. long)	19.00 to 19.50
Stove plate	21.00 to 22.00
Locomotive grate bars	24.00 to 25.00
Malleable cast (railroad)	23.00 to 23.50
Old carwheels	30.00 to 31.00

Prices which dealers in New York and Brooklyn are quoting to local foundries, per gross ton:

No. 1 machinery cast	$32.00 to $33.00
No. 1 heavy cast (columns, building materials, etc.), cupola size	31.00 to 32.00
No. 1 heavy cast, not cupola size	24.50 to 25.00
No. 2 cast (radiators, cast boilers, etc.)	23.00 to 24.00

Cast Iron Pipe.—The usual holiday slack period has entered this line, but manufacturers have all the business they desire and are maintaining prices. The city of Newark has awarded 2200 tons of pipe to the Warren Foundry & Machine Co. at practically the market price. Makers comment on the large number of sellers of raw material who have been canvassing them lately, which they think indicates inactivity or the attaining of top-notch prices at which the holders of raw material wish to unload. We quote 6-in. and heavier at $62.30, New York; 4-in., $65.30, with $2 additional for Class A and gas pipe.

St. Louis

ST. LOUIS, Dec. 29.

Pig Iron.—The holiday week was naturally rather quiet, although the call for small lots for prompt shipment continues. Inquiries are considerable in the aggregate, a number of them being from the Iowa territory, which looks to the St. Louis furnace representatives for supplies. Prices are firmer and somewhat higher, according to reports of representatives, but no open figures for the market are being made for Northern or Southern iron.

Finished Iron and Steel—Finished products continue in short supply and receipts by warehouses or on contracts are not equal to the requirements of consumers. However, there is some betterment in the aggregate received from the mills. Much more material could be used, both on contract deliveries and out of warehouse if it were obtainable. For stock out of warehouse we quote as follows:

Soft steel bars, 3.44c.; iron bars, 3.44c.; structural material, 3.54c.; tank plates, 3.74c.; No. 10 blue annealed sheets, 4.89c.; No. 28 black sheets, cold rolled, one pass, 5.99c.; No. 28 galvanized sheets, black sheet gage, 7.34c.

Old Material.—The scrap dealers maintain their optimistic state and continue to speculate among themselves, so far as that is possible, with all of them on the bullish side of the market. Consumers continue to want scrap for future delivery, but at the moment do not care to take it in until their inventories are completed for the calendar year. No material is being offered just now either by the railroads or by the industries or country dealers, although some offerings are anticipated after the turn of the month and the year. We quote dealers' prices, f.o.b. customers' works, St. Louis industrial district, as follows:

Per Gross Ton	
Old iron rails	$27.50 to $28.00
Old steel rails, rerolling	32.50 to 33.00
Old steel rails, less than 3 ft.	25.00 to 25.50
Relaying rails, standard sections, subject to inspection	38.00 to 45.00
Old car wheels	29.50 to 30.00
No. 1 railroad heavy melting steel	23.50 to 24.00
Heavy shoveling steel	21.50 to 22.00
Ordinary shoveling steel	21.00 to 21.50
Frogs, switches and guards, cut apart	25.00 to 25.50
Ordinary bundled sheets	13.50 to 14.00
Heavy axle and tire turnings	17.00 to 17.50
Per Net Ton	
Iron angle bars	25.50 to 26.00
Steel angle bars	21.50 to 22.00
Iron car axles	34.50 to 35.00
Steel car axles	33.50 to 34.00
Wrought arch bars and transoms	28.00 to 28.50
No. 1 railroad wrought	23.00 to 23.50
No. 2 railroad wrought	22.00 to 22.50
Railroad springs	22.00 to 22.50
Steel couplers and knuckles	22.00 to 22.50
Locomotive tires, 42 in. and over, smooth inside	21.00 to 21.50
No. 1 dealers' forge	20.50 to 21.00
Cast iron borings	11.50 to 12.00
No. 1 busheling	22.00 to 22.50
No. 1 boiler, cut to sheets and rings	17.00 to 17.50
No. 1 railroad cast	30.00 to 30.50
Stove plate and light cast	27.00 to 27.50
Railroad malleable	23.00 to 23.50
Agricultural malleable	22.50 to 23.00
Pipes and flues	18.50 to 19.00
Heavy railroad sheet and tank	17.50 to 18.00
Railroad grate bars	26.50 to 27.50
Machine-shop turnings	13.00 to 13.50
Country mixed	19.00 to 19.50
Uncut railroad mixed	20.00 to 21.00
Horseshoes	22.50 to 23.00

Boston

BOSTON, Dec. 30.

Pig Iron.—While prices are materially higher than they were a week ago, that feature of the market is not as conspicuous as is the scarcity of offerings. The largest individual sale of eastern Pennsylvania, silicon 2.25 to 2.75, reported for the past week, is one of 500 tons to a Providence, R. I., consumer, second quarter delivery, at $40, furnace. After accepting this order the furnace withdrew from the market. Other Pennsylvania No. 2 X sales include two cars, prompt delivery, to a Massachusetts consumer, at $42, furnace; 100 tons to a Rhode Island and 100 tons to a Maine consumer, first quarter delivery, at $40, furnace. Scattering car lots for prompt delivery of eastern Pennsylvania have been sold by foundries on a basis of $42 to $43, furnace. Early in the week several 100-ton lots

of iron sold at less than $40, furnace, but the market since Christmas has been at or above that price. Quotations on Buffalo iron are nominal, as it is impossible to secure even car lots. One thousand tons of Alabama, silicon, 3.75 to 4.25, first quarter delivery, at $43, furnace, was bought by a Massachusetts consumer. One sale of 400 tons Alabama, silicon 2.25 to 2.75, first quarter delivery, and several smaller lots to Massachusetts consumers at $40 to better than $41, are included in past week's business. The new Alabama water and rail rates to New England points are effective as of Dec. 24. Copies of the new tariff have not been received here to date, and some doubt is expressed as to the basis of the new rates. It is presumed, however, that the rates are based on 1917 tariff, plus the 25 per cent increase covered by the Railroad Administration's general order No. 42. On that basis the rate to Boston is $4.50 per ton, the handling charge 40c., the rate to Worcester, for instance, 75c., plus the 25 per cent increase as per order No. 42, or $1.41, making a total of $7.06 a ton, as compared with $8, as heretofore. With Alabama No. 2 plain on a basis of $38, furnace, the iron landed at Worcester would cost $45.06. A Massachusetts consumer has bought a car of Lake Superior charcoal at $45, furnaces, and another a small tonnage of Connecticut high-grade special charcoal at $62.25, furnace.

Eastern Pa., No. 2 X, silicon 2.25 to 2.75	$44.90 to $45.90
Eastern Pa., No. 2 plain, silicon 1.75 to 2.25	43.90 to 44.90
Buffalo, No. 2 X, silicon 2.25 to 2.75.	44.90 to 45.90
Buffalo, No. 2 plain, silicon 1.75 to 2.25	43.90 to 44.90
Virginia, No. 2 X, silicon 2.25 to 2.75.	43.95 to 44.95
Virginia, No. 2 plain, silicon 1.75 to 2.25	42.70 to 43.70
Alabama, No. 2 X, silicon 2.25 to 2.75	45.95 to 46.95
Alabama, No. 2 plain, sil. 1.75 to 2.25	44.70 to 45.70

Old Material.—Pennsylvania consumers continue buyers of heavy steel and borings and turnings. Sales for the past week, however, are not as heavy as reported for the previous week. The market on No. 1 railroad wrought is $1 to $1.50 higher. One dealer paid $27 at yard for 100 tons, a new high record for 1919, but this price is exceptional. The market on No. 1 yard wrought is a shade easier because of increased offerings. The cast market is quieter, a majority of foundries having covered their requirements to June next. Small yards report the market on No. 1 machinery cast as $34, as against $32 to $33, the general quotation. In such cases the material has been unusually well picked over. One Boston dealer reports inquiries for 700 tons No. 1 machinery which he cannot fill. Quotations on railroad malleable are considerably stronger, while those on rerolling rails are a shade easier.

No. 1 heavy melting steel	$17.00 to $18.00
No. 1 railroad wrought	25.50 to 26.50
No. 1 yard wrought	21.00 to 22.00
Wrought pipe (1 in. in diameter, over 2 ft. long)	17.00 to 18.00
Machine-shop turnings	13.00 to 13.50
Cast iron borings	16.00 to 17.50
Heavy axle turnings	15.50 to 16.00
Blast furnace borings and turnings	12.50 to 13.00
Forge scrap	13.50 to 14.00
Bundled skeleton	13.50 to 14.50
Steel car axles	27.00 to 28.00
Car wheels	28.00 to 29.00
Machinery cast	32.00 to 33.00
No. 2 cast	29.00 to 30.00
Stove plate	21.00 to 22.00
Railroad malleable	20.00
Rerolling rails	27.00 to 28.00

The Atlantic Tubing Co., Providence, R. I., is insuring, free of charge, all employees who have been with the concern at least six months. Initial payments will be $500, and in each succeeding year the amount will be increased $250 until a maximum of $1,000 is reached. Employees also are entitled to free visiting nurse service in case of sickness or injury.

The Pollock Steel Co., Cincinnati, purchased on Dec. 1, 1919, from the Interstate Iron & Steel Co., its complete rolling mill at Marion, Ohio. This is practically a new plant and was erected only three years ago for the manufacture of angles, bars, channels, tees, shapes, special small shapes, concrete reinforcing bars, etc.

British Prices Still Advancing

Tin Plate Demand Insatiable—Fancy Prices for Galvanized Sheets—Inquiries Heavy

(*By Cable*)

LONDON, ENGLAND, Dec. 29.

The usual holiday dullness prevails, but there are still many domestic and foreign inquiries. Prices have an upward tendency. An advance in coke of 10s. is expected and an increase in railroad rates is certain.

The tin plate market is still rampant and the demand is insatiable, with buyers willing to pay almost any price. The basis price for January-March delivery is 51s. 6d. and that for April-June delivery 50s. 6d. The Welsh output is only 70 per cent of capacity. Galvanized sheets are quoted at £43 to £44, basis, and there is a growing demand for thin gages, but works are practically full until August and are demanding fancy prices. Sheet and tin plate bars are quoted at £16 10s. to £17 and rails at £17 10s. to £18.

The output of coal for the week ended Dec. 13 was 4,886,000 tons as compared with 4,806,000 tons for the week ended Dec. 6.

We quote per gross ton, except when otherwise stated, f.o.b. makers' works, with American equivalents figured at $3.80 for £1 as follows:

	£	s.	d.		£	s.	d.			
Ship plates	22	0	0	to	23	0	0	$83.60	to	$87.40
Boiler plates	25	0	0	to	28	0	0	95.00	to	106.40
Tees	18	15	0	to	19	15	0	71.25	to	75.05
Channels	18	0	0	to	19	0	0	58.40	to	62.20
Beams	18	15	0	to	19	5	0	71.25	to	76.00
Round bars, ¾ to 3 in.	21	15	0	to	22	15	0	82.65	to	86.45
Rails, 60-lb. and up	17	10	0	to	18	0	0	66.50	to	71.25
Billets and sheet bars	16	10	0	to	17	0	0	62.70	to	64.60
Steel hoops	25	15	0	to	26	0	0	97.85	to	98.80
Tin plates	0	51	6					9.78		
Galv. sheets, 24 g.	43	0	0	to	44	0	0	163.40	to	167.20

Demand for Steel Overwhelming—Shortage of Cars a Factor—Pig Iron Scarce and Higher

(*By Mail*)

LONDON, ENGLAND, Dec. 12.—The iron and steel trades are still experiencing a period of extraordinary activity so far as business which is being offered is concerned. Unfortunately much of this must be turned down, owing to the already heavily booked condition of makers, the shortage of some materials, and the virtual paralysis caused by the shortage of cars and general railroad congestion. The latter feature is the one which is exerting the greatest amount of influence on the business of the country.

There is not very much moving for overseas markets, partly owing to a shortage of bottoms and partly also owing to the difficulty in procuring the foundry iron which is the quality chiefly in demand for export. The price of No. 1 is steady at the advanced figure of 167s. 6d., while No. 3 Cleveland is steady at 160s. For forge qualities 160s. is also asked and for export 5s. more in each case. Hematite is steady and quieter.

In steel there is an overwhelming demand, and the chief difficulty is to find sellers. Owing to the industrial troubles in the United States nearly all overseas markets are turning to this country for supplies of steel, and the latest development is that America herself has been endeavoring to purchase in this country for consumption in the United States. Meanwhile, unfortunately at least, three large works in the North of England, the Britannia Mills, Cargo Fleet and Consett Iron Co. were obliged to stop owing to the car difficulty. This, needless to say, is generally regarded very regrettable, as the country has now an excellent opportunity to secure trade in all parts of the world. As it was there were already sufficient troubles and difficulties, with the lack of skilled labor and shorter hours, and some of the shipyards on the Clyde are much hampered for lack of material. Fortunately the Britannia Mills have been able to restart.

The general offices of the Laclede Steel Co. have moved to the Arcade Building, St. Louis.

Non-Ferrous Metals

Cents Per Pound for Early Delivery

	Copper, New York		Tin,	Lead		Spelter	
		Electro-	New	New	St.	New	St.
Dec.	Lake	lytic	York	York	Louis	York	Louis
23....	19.00	18.75	56.50	7.35	7.10	8.70	8.35
24....	19.00	18.75	57.50	7.45	7.20	8.85	8.50
26....	19.25	18.87½	57.50	7.50	7.25	8.97½	8.62½
27....	19.25	19.00	.....	7.62½	7.37½	9.10	8.75
29....	19.50	19.25	59.25	7.75	7.50	9.35	9.00

NEW YORK, Dec. 30.

The year closes with nearly all the markets active and in most cases prices advancing. Demand and buying in copper is heavier. The tin market is quiet, but spot prices have advanced, due to a higher speculative market in London and to firmer exchange values. Prices for lead continue to advance and supply is not equal to demand. The zinc market is higher because of better domestic and foreign buying. Antimony is quiet and unchanged.

New York

Copper.—Due to a better demand from domestic consumers and a considerable increase in buying by Japan and Great Britain, and some other countries, the copper market advanced considerably in the last day or two. In only one or two cases can electrolytic copper for January delivery be obtained as low as 19c., New York. Most producers are asking 19.25c. to 19.50c., New York, which we quote as the market. Lake copper is correspondingly higher at 19.50c. to 19.75c., New York, for January delivery. The better situation in foreign exchange as well as a realization by domestic consumers that a buying movement is in progress are the causes for the stronger situation.

Tin.—The tin market has been dull and uninteresting and the situation has changed but little from that reported a week ago. Prices for spot tin have advanced almost daily, due largely to the higher values for sterling exchange, as well as to the fact that the London market has been advancing very rapidly. Yesterday spot Straits in London showed an increase of £7 15s. over the price prevailing on Dec. 27. As a consequence the same brand at New York was quoted yesterday at about 59.25c. Future shipment from the Straits is nominal at about 59.50c., with some sellers asking 60c. The London market is largely a speculative one, and is believed to be closely controlled. As the result of the foregoing conditions American buyers are holding off, and there is and has been very little activity on this side. Tin arrivals thus far this month have been 4928 tons, of which 3738 tons is credited to Atlantic ports. The quantity afloat is 3275 tons.

Lead.—The lead market continues to advance, due almost entirely to the fact that supply is not equal to demand. Buyers are evidently frightened and are bidding the market up on themselves. On Dec. 26 the American Smelting & Refining Co. advanced its price again from 7.15c. to 7.50c., New York, or 7.25c., St. Louis. The outside market has already exceeded these values and yesterday the prevailing quotations were 7.50c., St. Louis, or 7.75c., New York, with sales of some brands as high as 8c., New York.

Zinc.—Demand both from American brass makers and from foreign consumers is again much better, which, coupled with the firmer situation in foreign exchange and the strong technical position of producers, has caused the market to advance until prime Western for early delivery was quoted and sold yesterday from 8.95c. to 9.05c., St. Louis, or 9.30c. to 9.40c., New York. We quote the market for prime Western delivery at 9c., St. Louis, or 9.35c., New York. It is reliably stated that British smelters cannot produce the metal for less than 11c. per lb., which accounts in part for the British buying in this market.

Antimony.—Quotations for wholesale lots for early delivery are unchanged at 9.62½c., New York, duty paid.

Aluminum.—Quotations continue nominal at 32c. to 33c., New York, for early delivery of wholesale lots of virgin metal, 98 to 99 per cent pure.

Old Metals.—The market is firm. Dealers' selling prices are reported as follows:

	Cents per lb.
Copper, heavy and crucible	19.00
Copper, heavy and wire	18.00
Copper, light and bottoms	16.50
Brass, heavy	13.00
Brass, light	9.00
Heavy machine composition	18.00
No. 1 yellow rod brass turnings	11.00
No. 1 red brass or composition turnings	15.50
Lead, heavy	6.50
Lead, tea	4.50
Zinc	5.50

St. Louis

ST. LOUIS, Dec. 29.—The non-ferrous markets have been firm, with lead in carload lots at 7.15c. and spelter at 8.60c. In less than carload lots the prices have been: Lead, 7.35c.; spelter, 9c. to 9.10c.; tin, 60c.; copper, 20.50c.; antimony, 11.50c. In the Joplin market ores have been firmer and somewhat higher, but the market has not been particularly active because of the holiday period. Zinc blende is about $2.50 per ton higher, with lead ore commanding $90 per ton and calamine $33 per ton, basis 60 per cent, 80 per cent and 40 per cent respectively. On miscellaneous scrap metals we quote dealers' buying prices as follows: Light brass, 8c.; heavy yellow brass, 10c.; heavy red brass, 15c.; light copper, 13c.; heavy copper and copper wire, 16c.; zinc, 4c.; lead, 4.50c.; tea lead, 3c.; pewter, 35c.; tinfoil, 43c.; aluminum, 22c.

Steel & Tube Co. of America Extensions

The Steel & Tube Co. of America, 425 East Water Street, Milwaukee, has placed a contract with the Worden-Allen Co. of Milwaukee for extensions and addition to its Mark plant at Indiana Harbor, Ind., requiring a total of 2935 tons of structural material. The items of the contract are: Cupola yard building, 150 tons; cupola building, 180 tons; mixer building, 300 tons; scrap yard craneway, 400 tons; extension to scrap yard, 400 tons; large boiler house, 500 tons; two boiler houses, 225 tons; pipe mill extension, 200 tons; power house addition, 60 tons; office addition, 20 tons.

Warren Foundry Purchased

Reorganization of the Aetna Foundry & Machine Co., Warren, Ohio, has been effected through purchase by Youngstown men of the holdings of Pittsburgh interests. M. I. Arms, II, former treasurer of the Republic Rubber Corporation, Youngstown, Ohio, has been elected president and treasurer and named general manager, and M. C. Boyd has been chosen secretary. The company specializes in tinning machinery and galvanizing equipment, and also manufactures rolling mill machinery. Additions to increase capacity are now being designed.

A bronze bust of Alexander L. Crawford, industrial leader and pioneer in the production of block coal and iron in western Pennsylvania and Indiana, has been installed in the McKinley Memorial Building at Niles, Ohio. Mr. Crawford shipped the first Lake ore in 1850, and was the first to reduce the cost of pig iron by utilizing waste gases of blast furnaces. He owned furnaces in Pennsylvania, Ohio, Indiana and Missouri, and built railroads in Pennsylvania, Ohio, Missouri and Tennessee.

The Century Steel Co., Poughkeepsie, N. Y., has issued $500,000 in 7 per cent five-year notes redeemable at will of company at any time at 102 and interest.

Prices Finished Iron and Steel, f.o.b. Pittsburgh

(Prices quoted below represent as closely as they can be given those charged by mills to their regular trade for indefinite shipment. Owing to practical famine in supply of finished steel products and the heavy demand existing, tenders of new business are being made to the mills by jobbers and consumers at higher prices than those quoted below, but as a rule the mills are turning this offered business away.)

Freight rates from Pittsburgh on finished iron and steel products, including wrought iron and steel pipe, with revisions effective Nov. 1, 1918, in carloads, to points named, per 100 lb., are as follows: New York, 27c.; Philadelphia, 24.5c.; Boston, 30c.; Buffalo, 17c.; Cleveland, 17c.; Cincinnati, 23c.; Indianapolis, 25c.; Chicago, 27c.; St. Louis, 34c.; Kansas City, 59c.; St. Paul, 49.5½c.; Denver, 99c.; Omaha, 59c.; minimum carload, 80,000 lb. to four last named points; New Orleans, 38.5c.; Birmingham, 57.5c.; Pacific Coast, $1.25; minimum carload, 80,000 lb. To the Pacific Coast the rate on steel bars and structural steel is $1.315, minimum carload, 40,000 lb.; and $1.25 minimum carload, 50,000 lb. On wrought iron and steel pipe the rate from Pittsburgh to Kansas City is 50c. per 100 lb., minimum carload 46,000 lb.; to Omaha, 50c., minimum carload 46,000 lb.; to St. Paul and Minneapolis, 49.5c., minimum carload 46,000 lb.; Denver, 99c., minimum carload 46,000 lb. Jacksonville, Fla., all rail, car lots, 41.5c.; less, 59c.; rail and water, car lots, 34.5c.; less, 46.5c. A 3 per cent transportation tax applies. On iron and steel items not noted above, rates vary somewhat and are given in detail in the regular railroad tariffs.

Structural Material

I-beams, 3 to 15 in.; channels, 3 to 15 in.; angles, 3 to 6 in., on one or both legs, ¼ in. thick and over, and zees, structural size, 2.45c.

Wire Products

Wire nails, $3.25 to $4.50 base per keg; galvanized, 1 in. and longer, including large-head barbed roofing nails, taking an advance over this price of $1.50, and shorter than 1 in., $2.00. Bright basic wire, $3 to $3.25 per 100 lb.; annealed fence wire, Nos. 6 to 9, $3 to $3.25; galvanized wire $3.70 to $3.95; galvanized barbed wire and fence staples, $4.10 to $4.45; painted barbed wire, $3.40 to $3.75; polished fence staples, $3.40 to $4.50; cement-coated nails, $3.45 base; these prices being subject to the usual advances for the smaller trade, all f.o.b. Pittsburgh, freight added to point of delivery, terms 60 days net, less 2 per cent off for cash in 10 days. Discounts on woven-wire fencing are 60 per cent off list for carload lots, 59 per cent for 1000-rod lots, and 58 per cent off for small lots, f.o.b. Pittsburgh.

Bolts, Nuts and Rivets

Large structural and ship rivets.....$4.10 base
Large boiler rivets.....$4.20
Small rivets, ¼ in., 5/16 in. and 7/16 in. diameter, 50 per cent off list
Machine bolts, hp. nuts, ⅜ in. x 4 in.:
Smaller and shorter, rolled threads.50 and 10 per cent off list
Cut threads.....50 per cent off list
Larger and longer sizes.....40 and 5 per cent off list
Machine bolts c.p.c. and t. nuts, ⅜ in. x 4 in.:
Smaller and shorter.....40 and 5 per cent off list
Larger and longer.....35 and 5 per cent off list
Carriage bolts, ⅜ in x 6 in.:
Smaller and shorter, rolled threads.45 and 5 per cent off list
Cut threads.....40 and 5 per cent off list
Larger and longer sizes.....30 and 10 per cent off list
Lag bolts.....50 and 10 per cent off list
Plow bolts, Nos. 1, 2 and 3.....50 per cent off list
Plow bolts, Nos. 4 to 10.....50 plus 20 per cent off list
Hot pressed nuts, sq. blank.....2.50c per lb. off list
Hot pressed nuts, hex. blank.....2.50c. per lb. off list
Hot pressed nuts, sq. tapped.....2.25c. per lb. off list
Hot pressed nuts, hex. tapped.....2.25c. per lb. off list
C.p.c. and t. sq. and hex. nuts, blank....2.50c. per lb. off list
C.p.c. and t. sq. and hex. nuts, tapped....2.25c. per lb. off list
Semi-finished hex. nuts.:
⅝ in. and larger.....65 per cent off list
9/16 in. and smaller.....70 and 10 per cent off list
Stove bolts in packages.....75-10 per cent off list
Stove bolts in bulk.....75-10-2½ per cent off list
Tire bolts.....60-10 per cent off list

The above discounts are from Nov. 1, 1919.
All prices carry standard extras, Pittsburgh basis.

Wire Rods

No. 5 common basic or Bessemer rods to domestic consumers, $52 to $65; chain rods, $65 to $70; screw rivet and bolt rods and other rods of that character, $65 to $70. Prices on high carbon rods are irregular. They range from $75 to $100, depending on carbons.

Railroad Spikes and Track Bolts

Railroad spikes, ½ in., 9/16 in. and larger, $3.35 per 100 lb. in lots of 200 kegs of 200 lb. each or more; spikes, ⅜ in., 7/16 in. and smaller $3.85 to $4 per 100 lb. in lots of 200 kegs of 200 lb. each or more; track bolts, $4.35 to $4.50 per 100 lb. in carload lots of 200 kegs or more, with the usual extras for small lots. Boat and barge spikes, $3.85 to $4 per 100 lb. in carload lots of 200 kegs or more, f.o.b. Pittsburgh.

Terne Plates

Prices of terne plates are as follows: 8-lb. coating, 200 lb., $13.80 per package; 8-lb. coating, I. C., $14.10; 12-lb. coating, I. C., $15.80; 15-lb. coating, I. C., $16.80; 20-lb. coating, I. C., $18.05; 25-lb. coating, I. C. $19.30; 30-lb. coating, I. C., $20.30; 35-lb. coating, I. C., $21.30; 40-lb. coating, I. C., $22.30 per package, all f.o.b. Pittsburgh, freight added to point of delivery.

Iron and Steel Bars

Steel bars at 2.35c. to 2.75c. from mill. Bar iron, 3.50c.

Wrought Pipe

The following discounts are to jobbers for carload lots on the Pittsburgh basing card:

Butt Weld

Steel			Iron		
Inches	Black	Galv.	Inches	Black	Galv.
⅛, ¼ and ⅜	50½	24	⅛ and ¼	29½	2½
½	54½	40	⅜	30½	3½
¾ to 3	57½	44	½	34½	16½
			¾ to 1½	30	23½

Lap Weld

2	50½	38	1¼	24½	9½
2½ to 6	53½	41	1½	31½	17½
7 to 12	50½	37	2	32½	18½
13 and 14	41	..	2½ to 6	34½	21½
15	38½	..	7 to 12	31½	18½

Butt Weld, extra strong, plain ends

⅛, ¼ and ⅜	46½	29	⅛, ¼ and ⅜	28½	11½
½	51½	39	½	33½	20½
¾ to 1½	55½	43	¾ to 1½	39½	24½
2 to 3	56½	44			

Lap Weld, extra strong, plain ends

2	48½	37	1¼	25½	10½
2½ to 4	51½	40	1½	31½	17½
4½ to 6	50½	39	2	33½	20½
7 to 8	46½	33	2½ to 4	35	23½
9 to 12	41½	28	4½ to 6	34½	22½
			7 to 8	26½	14
			9 to 12	21½	9½

To the large jobbing trade an additional 5 per cent is allowed over the above discounts, which are subject to the usual variations in weight of 5 per cent.

On butt and lap weld sizes of black iron pipe, discounts for less than carload lots to jobbers have been seven (7) points lower (higher price) than carload lots and on butt and lap weld galvanized iron pipe have been nine (9) points lower (higher price).

Boiler Tubes

The following are the prices for carload lots, f.o.b. Pittsburgh:

Lap Welded Steel		*Charcoal Iron*	
3½ to 4½ in.	40½	3½ to 4½ in.	—16
2½ to 3¼ in.	30½	3 to 3¼ in.	— 1½
2¼ in.	24	2½ to 2¾ in.	+ 1
1¾ to 2 in.	19½	2 to 2¼ in.	+10
		1¾ to 1⅞ in.	+20

Standard Commercial Seamless—Cold Drawn or Hot Rolled

Per Net Ton		Per Net Ton	
1 in.	$327	1¾ in.	$207
1¼ in.	267	2 to 2½ in.	177
1⅜ in.	257	2¾ to 3¾ in.	167
1½ in.	207	4 in.	187
		4½ to 5 in.	207

These prices do not apply to special specifications for locomotive tubes nor to special specifications for tubes for the Navy Department, which will be subject to special negotiations.

Sheets

Makers' prices for mill shipments on sheets of United States standard gage in carload and larger lots are as follows:

Blue Annealed—Bessemer

	Cents per lb.
No. 8 and heavier	3.50
Nos. 9 and 10 (base)	3.55
Nos. 11 and 12	3.60
Nos. 13 and 14	3.65
Nos. 15 and 16	3.75

Box Annealed, One Pass Cold Rolled—Bessemer

Nos. 17 to 21	4.15
Nos. 22 to 24	4.20
Nos. 25 and 26	4.25
No. 27	4.30
No. 28 (base)	4.35
No. 29	4.45
No. 30	4.55

Galvanized, Black Sheet Gage—Bessemer

Nos. 10 and 11	4.70
Nos. 12 to 14	4.80
Nos. 15 and 16	4.95
Nos. 17 to 21	5.10
Nos. 22 to 24	5.25
Nos. 25 and 26	5.40
No. 27	5.55
No. 28 (base)	5.70
No. 29	5.95
No. 30	6.20

Tin-Mill Black Plate—Bessemer

Nos. 15 and 16	4.15
Nos. 17 to 21	4.20
Nos. 22 to 24	4.25
Nos. 25 to 27	4.30
No. 28 (base)	4.35
No. 29	4.40
No. 30	4.40
Nos. 30½ and 31	4.45

PERSONAL

I. Lamont Hughes, president Lorain Steel Co., Johnstown, Pa., a subsidiary of the Carnegie Steel Co., arrived in Youngstown, Ohio, Dec. 30 to assume his new duties as district superintendent of the Carnegie company, succeeding James H. Grose, resigned. For 11 years Mr. Hughes was identified with Carnegie company interests in Youngstown and is therefore no stranger to the district. His appointment was received with pleasure by the local Carnegie organization as well as by district steel men in general. Reared in New Castle, Pa., Mr. Hughes later went to Braddock, Pa. He left school in Pittsburgh to take a position with the Carnegie Steel Co. and was later transferred to the corporation's mills at Donora, Pa. From Donora he went to Youngstown in 1905 to be master mechanic at the Upper and Lower Union Mills. He was made assistant general superintendent a few years later. Mr. Hughes next took charge of the finishing mills, as superintendent of bar mills. On Jan. 1, 1916, he was appointed assistant district superintendent, at the time Mr. Grose was named district superintendent. He was next made general superintendent of the Steel Corporation's plant at Ojibway, Canada, built with special reference to the production of war material for the Canadian and British governments. Mr. Hughes was then transferred to the Neville Island works of the Steel Corporation, with the title of assistant general superintendent of the ordnance department. He was promoted to superintendent when John S. Oursler was named general superintendent of the Homestead works of the Carnegie Steel Co. Mr. Hughes was chosen president of the Lorain Steel Co., Johnstown, Pa., to succeed Daniel Coolidge, who retired because of ill health, shortly after the Steel Corporation abolished its ordnance department.

I. LAMONT HUGHES

James H. Grose, who retires Dec. 31 as district superintendent of the Carnegie Steel Co. at Youngstown, was given a farewell reception Dec. 27 and presented with a silver tea set. There were 360 in attendance, the function being held in the Ohio hotel. L. N. McDonald, assistant district superintendent, was chairman and A. C. Cook, in charge of the claims and welfare department, was toastmaster. J. V. Schrock, district chief clerk, spoke of the cordial relations that have existed between Mr. Grose and the Carnegie staff. Among the speakers were foremen and employees in the various plants of the company over which Mr. Grose had jurisdiction.

Prof. Brainerd Mears, Williams College, Williamstown, Mass., will deliver an illustrated lecture on iron and steel at a meeting of the White Oaks Community Club, Friday evening, June 2, at Pittsfield, Mass.

David L. Julian, formerly with the E. J. Manville Machine Co., Waterbury, Conn., but for the past year and a half with Columbus Bolt Works, Columbus, Ohio, is returning to the former company as assistant superintendent.

E. M. Herr, president Westinghouse Electric & Mfg. Co., East Pittsburgh, has been appointed chairman of the Ecuador group at the second Pan-American financial conference, to be held at Washington, Jan. 12 to 17. Mr. Herr was appointed last year to the same conference, but press of war duties had made it impossible for him to serve, but he expects to serve this year. J. Rogers Flannery of the American Vanadium Co., Pittsburgh, will serve in the group meeting the Bolivian delegates.

John W. Phillips has been made manager of the tool steel department of the Aborn Steel Co., Inc., and will be located at the company's main office, 22 Clark Street, New York.

L. S. Devos, consulting engineer, has resigned his export connection with the Becker Milling Machine Co., Reed-Prentice Co. and Whitcomb-Blaisdell Machine Tool Co., but is still acting in a similar capacity for the Giddings & Lewis Mfg. Co., as well as the Stockbridge Machine Co. The office of these latter two factories, as well as that of Mr. Devos, has been removed from 24 Stone Street to 165 Broadway, New York, Room 818. The telephone number is Cortlandt 6281.

Lawrence M. Brile, who has been for the last five years with the United Smelting & Aluminum Co., Inc., New Haven, Conn., as vice-president and sales manager, has severed his connection with that company to take effect on Jan. 1, to become president of Brile & Ratner, Inc., New York, metal and chemical brokers. Mr. Brile will take charge of the non-ferrous metal end of the business, while Mr. Ratner will take charge of the chemical department. Temporarily the office of Brile & Ratner, Inc., will be located at 115 Broadway, New York.

At a special meeting of the board of directors of the Signal Motor Truck Co., Detroit, James G. Heaslet was elected president to fill the unexpired term of W. K. Hoagland, who has resigned.

Alphons L. Orschell has resigned as brass foundry superintendent of the Lunkenheimer Co., Cincinnati, and is now associated with the Hill & Griffith Co., Cincinnati, foundry equipment.

Kenneth B. Lewis, Morgan Construction Co., Worcester, Mass., has returned from a six months trip through Europe in the interest of his company. He says that French manufacturers will fight German competition with American efficiency. He secured a large amount of export business.

A. A. Blue has been appointed by the Duff Mfg. Co., Pittsburgh, lifting jacks, to take charge of its heat treating department. Mr. Blue is a graduate of the chemical engineering department of Cornell University. For two years he was with the Midvale Steel Co. in the heat treating department, and during the war served as assistant superintendent of heat treating and forge shop of the gun plant at the Watertown Arsenal.

C. F. Hutchings, formerly sales manager for the Hayward Co., 50 Church Street, New York is now New York manager for the Blaw-Knox Co., Pittsburgh.

Ray Gheen has resigned as secretary to the assistant general superintendent of the Youngstown Sheet & Tube Co., Youngstown, Ohio, to become officially identified with the Ohio Steel Products Co., Mineral Ridge, Trumbull County, Ohio.

A. E. DeClercq has joined the Cleveland sales force of the Tacony Steel Co., Philadelphia. Mr. DeClercq, who is assigned to Detroit and vicinity, is a metallurgist of 12 years experience, having been with the Timken-Detroit Axle Co., Park Drop Forge Co., Chalmers Motor Car Co., and Fisher Body Corporation.

G. W. Jacobus, who represented the J. E. Mergott Co., manufacturer of advertising specialties in metal, Newark, N. J., in New York and vicinity for the past several years, has severed his connections with the company.

C. F. Rogers, who, during the entire period of the war, served as chief Government inspector on the Vickers and Browning machine guns, both ground and aircraft types, has joined the sales organization of the C. E. Johansson, Inc., Poughkeepsie, N. Y., in the capacity of special representative. Mr. Rogers, who is a mechanical engineer and a member of the A. S. M. E., has a large practical experience in tool making and tool inspection and has previously been employed at the

Elgin National Watch Co., Elgin, Ill., Windsor Machine Co., Windsor, Vt., and the Bosch Magneto Co., Springfield, Mass.

R. L. Baldwin, for several years active in the licensing of Heroult electric steel furnaces for the United States Steel Corporation, 71 Broadway, New York, assumes the duties of general sales manager for the Republic Carbon Co., Niagara Falls, N. Y., Jan. 1.

Clyde W. Blakeslee has resigned from the management of the Abrasive Co., Chicago store, effective Jan. 1, and will become sales manager, in charge of both domestic and foreign business for N. A. Strand & Co., manufacturers of flexible shafts and equipment. His headquarters will be 201 Machinery Hall, Chicago.

Hugo L. Siegel, formerly general sales manager for the Ford Roofing Products Co., is now with the Walter A. Zelnicker Supply Co., St. Louis, as assistant to the president. The Zelnicker company handles railroad, power plant, contractors', sawmill and industrial equipment and machinery.

L. R. Meisenhelter, Philadelphia, has accepted the position of special representative of the Houston, Stanwood & Gamble Co., Cincinnati, manufacturer of large lathes, and will devote his entire time to the sale of its lathes. Mr. Meisenhelter has disposed of his interest in the L. R. Meisenhelter Machinery Co.

William P. Starkey, general superintendent Harrisburg Pipe & Pipe Bending Co., Harrisburg, Pa., for the past six years, tendered his resignation, effective Dec. 31. He will continue his interest in the company as a member of the board of directors.

William J. Fisher, superintendent A. B. Farquhar Co., York, Pa., has been elected president of the Engineering Society of York.

C. H. Ruder, formerly with the Berger Mfg. Co., Canton, Ohio, is Pacific coast manager of the Canton Sheet Steel Co., Canton, Ohio, with offices at 811 Hearst Building, San Francisco.

OBITUARY

JOHN E. CLARK died at the Holyoke, Mass., city hospital Dec. 24. He was born at Ashland, Mass., June 24, 1848. Early in life he was a member of a New Haven, Conn., firm which manufactured tin and iron ware, and later owned a large interest in the Ford Auger Bit Co., being its treasurer at the time it was purchased by the Farr Alpaca Co., in 1916.

LOUIS J. MUELLER, president L. J. Mueller Furnace Co., Milwaukee, died Dec. 16, aged 82 years. He was born in New York State in 1837 and settled in Milwaukee in 1855, engaging in the hardware business. In 1885 he established the present concern to manufacture steam, hot water and hot air heating plants.

GEORGE B. BLAIR, founder of the Blair Foundry Co., Waukesha, Wis., died suddenly of heart trouble on Dec. 12. He was 35 years of age.

DANIEL F. VILES, president Waltham Screw Co., Waltham, Mass., died at the home of his son, Edgar Viles, in Concord, Mass., Dec. 24.

First of Twelve Steel Ships

BIRMINGHAM, ALA., Dec. 30.—The steamship Moschico, first of the 6500-ton steel ships to be built at Mobile by the Mobile Shipbuilding Co., of steel fabricated at the shops of the Birmingham Steel Corporation in Birmingham, was turned over to the Emergency Fleet Corporation, which leased it to private shippers, and it has started on its maiden voyage to South America. Eleven more are to be built.

Reading Iron Co. Buys Brooke Plant

The Reading Iron Co., Reading, Pa., has bought the plant of the E. & G. Brooke Iron Co. at Birdsboro, Pa. The acquisition of this property adds to the manufacturing equipment of the Reading Iron Co. 16 double puddling furnaces, with a three-high double muck mill, a 24-in. three-high skelp mill with four heating furnaces, and a cut nail factory of 75 nail machines. Through this addition to its manufacturing facilities the Reading Iron Co.'s skelp capacity is increased by 2800 tons per month, with a corresponding increase in the production of finished wrought-iron pipe.

The purchase of the E. & G. Brooke Iron Co. represents the second step in plant expansion which the Reading Iron Co. has made since the present executive management took charge a few months ago. Through the acquisition of the George B. Lessig Co. plant at Pottstown, Pa., last October, the Reading Iron Co. secured an additional muck bar capacity of 2600 tons per month and incidentally became the largest manufacturer of cut nails in the United States.

Through the acquisition of these plants the Reading Iron Co. brings its muck bar and skelp capacity up to the capacity of its tube works and thus controls the quality of the material entering into its wrought-iron pipe.

The Reading Iron Co. now possesses 136 double puddling furnaces, equivalent to 272 single furnaces.

Electric Alloy Steel Co. Organized

YOUNGSTOWN, OHIO, Dec. 30.—To manufacture high-grade alloy steels the Electric Alloy Steel Co. has been organized by local men with a capital of $1,500,000 and will build a new plant in Trumbull County, work to start in February. Incorporators are James A. Campbell, president Youngstown Sheet & Tube Co.; L. J. Campbell, vice-president of the same company; L. A. Manchester, A. E. Adams and Cecil D. Hine. L. J. Campbell has resigned from the Sheet & Tube company to become president of the new company, effective Jan. 1. The initial installation will consist of two electric furnaces, one 16-in. and one 10-in. rolling mill, and a 500-ton hammer. The hammer will take the place of a blooming mill and will be used for the production of forged steel. Barlon Shover, who designed and supervised the Brier Hill Steel Co. plant, will design the new plant.

Will Add to Deforest Sheet Mills

The Republic Iron & Steel Co., Youngstown, Ohio, has decided to add to its Deforest sheet mill plant at Niles, Ohio, eight hot sheet mills and six cold mills. The hot mills will be in units of four mills each and there will be two electric drives, each drive serving four mills. Contracts for these mills and for the electric drives have not yet been placed, but will be in a short time. The contract for the new sheet mill building, requiring 3500 tons of steel, has been placed with the McClintic-Marshall Co., Pittsburgh, and the electric cranes with the Alliance Machine Co., Alliance, Ohio. These are all the contracts placed thus far.

Propeller to be Launched

The steel self-propeller City of Birmingham, first of four to be built at St. Louis for Warrior River, Ala., use, will be launched Jan. 22, and will go down the Mississippi and thence up the Warrior to Birminghamport, Birmingham's new terminus on the Warrior River. Derricks are now being placed at Birminghamport for the inauguration of business on a rail and water rate 20 per cent under the all-rail rate.

The Status of the Electric Steel Industry

(*Continued from page 77*)

The Rennerfelt furnace is one of the most diversified as to application. There are 148 in the world, of which 100 are used in the steel industry, 32 in the non-ferrous industry, 11 in testing work and 4 in chemical work.

Developments in the World

Before and during the war Germany and Austria-Hungary were two of the largest European countries making electric steel. The effect of the peace treaty has been such that these countries have been so altered territorially that even an estimate of the status of the electric steel industry in those countries and hence in the world is impossible. The table, however, which was published a year ago is reproduced as a matter of record, and it is hoped that it will be possible to supply the missing information next year. If there were 815 furnaces in the world's electric steel industry on Jan. 1, 1919, there are over 1025 on Jan. 1, 1920, with the net increase of 32 furnaces in the United States and Canada for 1919, and allowing for discontinuances in some of the foreign countries.

Table of Electric Steel Furnaces by Countries of the World Operating or Contracted for on Jan. 1, 1918, with Totals for 1917, 1916, 1915, 1913 and 1910

	Total Jan. 1, 1919	Total Jan. 1, 1918	Total Jan. 1, 1917	Total Jan. 1, 1916	Total Jan. 1, 1915	Total July 1 1913	Total March, 1910
Germany and Luxemburg	...	91	52	53	46	34	20
Austria-Hungary	...	31	18	18	18	10	10
Switzerland	...	4	4	4	3	2	2
Italy	...	40	29	22	22	20	12
France	...	50	29	21	17	13	23
Great Britain	...	131	88	46	16	16	7
Belgium	...	...	3	3	3	3	3
Russia	...	21	16	11	9	4	2
Sweden	...	50	40	23	18	6	5
Norway	...	12	9	6	2	3	....
Spain	...	2	2	2	1	1	....
Japan	11	4	2	1	1	1	....
South Africa	...	2	1	1	1	4	3
Australia	2	1	1	1	1	....	....
Chile	3	2	....	1	....	....	....
Denmark	...	2	1	....	....	....	....
Brazil	2	....	....	....	....	....	....
India	1	....	....	....	....	....	....
Location not given	...	21	21	9	12	....	....
*Total outside the United States and Canada	...	464	316	222	170	118	101
United States	287	233	136	73	41	19	10
Canada	43	36	19	8	2	3	3
Total in the United States and Canada‡	330	269	155	81	43	22	13
Grand total in the world	815†	733	471	303	213	140	114

*Largely estimated on Jan. 1, 1918.
†Obtained by adding the known new installations to the estimate for Jan. 1, 1918.
‡The total in the United States on Jan. 1, 1920, is 323, with 40 in Canada, or 363 in both countries.

In England, on May 1, 1919, according to the latest published information, there were 151 electric furnaces in the British steel industry. Of these 53 were Heroult, 33 Electro-Metals, 33 Greaves-Etchells, 8 Stobie, 8 Snyder, 7 Rennerfelt, 4 Stassano, 2 induction, 2 Kjellin and one Girod. The electric steel output in Great Britain in 1918 was 147,922 gross tons.

As to Germany, following the occupation of the right bank of the Rhine and the separation of German Lorraine, Germany has lost important plants producing electric steel, says *Le Luxembourgeois*. In Lorraine the Thyssen-Hagendange steel plant had two 8-ton Heroult electric furnaces and one 20-ton furnace. The Rombach plant had one 2-ton Heroult furnace. In the Saar basin the Röchling-Rodenhausen plant and the Stumm plant at Neunkirchen each had an 8-ton Nathusius electric furnace. It is estimated that the number of electric steel furnaces in Germany was 90 early in 1919, of which 10 lay in the occupied territory. The German output of electric steel in 1918 was 221,824 metric tons, but up to date in 1919 the production had fallen to about 6000 tons per month.

As to production, data published in THE IRON AGE, Dec. 25, 1919, showed that the world's output from electric steel furnaces had been 1,155,273 tons in 1918 as compared with 844,074 tons in 1917 and 182,433 tons in 1913. The 1915 and 1916 output was 301,480 tons and 549,534 tons respectively. The United States led the world in 1918 with an output of 511,364 gross tons or about 50 per cent. of the total.

The net increase of over 12 per cent. in the electric furnace installations in the United States in 1919 is a favorable indication that the commanding lead attained over Germany in 1917 will expand rather than otherwise.

How Schools Will Buy Government Tools

Plans have been completed for the sale of Government-owned machine tools to educational institutions at 15 per cent of the original cost to the Government, as provided by the Caldwell bill. School authorities desiring to take advantage of this provision will first write to the director of sales, Munitions Building, Washington, D. C., for a questionnaire. When filled out and returned the director of sales will pass upon the eligibility of such institutions and be informed as to their machine tool requirements. The director will send purchasing coupons, one coupon being good for one machine. The applicant will receive regularly lists of surplus machine tools. An option of 10 days will be granted schools contemplating buying certain tools.

Upon receipt of notice that the selected machine tools are available for sale school authorities will forward shipping instructions, certified check for the amount of the purchase price and the necessary number of coupons. Purchasing institutions will pay the freight.

San Francisco Strike Settled

SAN FRANCISCO, Dec. 23.—The California Foundrymen's Association has reached an agreement with its men who have been on a strike since Oct. 1 in the various foundries affiliated with the association and the men have returned to work. By the terms of the agreement the men win their raise of eight cents an hour, making the basic wage $7.04. On the other hand the union makes a number of liberal concessions regarding shop rules, which the foundrymen expect to result in a decided increase in output. These matters of shop rules have been agreed to in principal and committees appointed to draft them in writing. The agreement is to remain in effect until April 1, 1921, and in case developments should show that the wage agreed upon is too high or too low, an adjustment may be made on this after Aug. 1, 1920. By this settlement the men return to work under union conditions in closed shops. Just what effect this settlement will have on the strike still pending in the machine shops is impossible to forecast.

Eastern Massachusetts Employers

The addresses delivered at the second annual meeting of the Employers' Association of Eastern Massachusetts, held at the Boston City Club, Dec. 23, concerned various phases of the labor question as confronting the employer today and tomorrow. Approximately 500 attended the meeting. The following were elected officers for the new year:

J. R. Kinney, Kinney Mfg. Co., Jamaica Plain, president; M. B. McLauthlin, George T. McLauthlin Co., Boston, first vice-president; Winslow Blanchard, Blanchard Machine Co., Cambridge, second vice-president; James A. Glass, Boston, treasurer. The board of managers includes Walter B. Douglas, New England Structural Co., Boston; George P. Aborn, Worthington Pump & Machinery Corporation, Cambridge; Albert C. Ashton, Ashton Valve Co., Cambridge; Charles L. Gilliatt, Norfolk Iron Works, Quincy; Ralph E. Thompson, Gillette Safety Razor Co., South Boston, and A. P Underhill, Chandler Motors of New England, Boston.

New Iron and Steel Works Construction

Open-Hearth Capacity Completed Last Year Only 625,000 Tons—That Now Building Represents 875,000 Tons—Blast Furnace Data

NEW open-hearth capacity completed and put in operation in the United States in 1919 was the smallest in many years. It was insignificant as compared with the large increases made in 1916, 1917 and 1918, and reflects the uncertain conditions following the ending of the world war. New work initiated or planned for 1920 is also small, some of it representing new construction intended for 1919 and now advanced into the 1920 program. New capacity in sight for 1920 is also the smallest in several years.

New Open-Hearth Capacity in 1919

In 1919 the new open-hearth capacity completed amounted to only 625,000 gross tons. This compares with 1,945,000 tons added in 1918, with 4,326,500 tons in 1917 and with 4,205,000 tons in 1916. The summary shows nine open-hearth furnaces completed in 1919, as compared with 46 in 1918, 97 in 1917 and 103 in 1916. The summary of the 1919 additions is as follows:

New Open-Hearth Furnaces Completed in 1919

	Number of Furnaces	Annual Capacity, Gross Tons
Independent Companies	8	350,000*
United States Steel Corporation	1	275,000†
Total	9	625,000

*Includes the conversion of two 30-ton furnaces to 80-ton capacity by the Canton Sheet Steel Co., Canton, Ohio, and one 60-ton to a 120-ton furnace by the Central Iron & Steel Co., Harrisburg, Pa. It also includes the new 700-ton mixer of the Inland Steel Co., Chicago.

†Includes new capacity due to one new converter at duplex open-hearth plant at the South Works of the Illinois Co., and a third furnace, 100-ton, at its duplex plant at Gary, Ind.

The additions to open-hearth capacity in 1919 were the following: McKinney Steel Co., Cleveland, two 100-ton furnaces; the Sharon Steel Hoop Co., Sharon, Pa., two 75-ton furnaces; the John A. Roebling & Sons Co., Trenton, N. J., two 40-ton furnaces, and the Andrews Steel Co., Newport, Ky., two 100-ton furnaces. The Inland Steel Co., Chicago, added one 100-ton mixer to its open-hearth department.

The United States Steel Corporation put in operation a third 100-ton open-hearth furnace at the Gary Works of the Illinois Steel Co., and also a new converter at the duplex open-hearth plant of the South Works of the same company.

Open-Hearth Construction for 1920

Open-hearth furnaces under construction, most of which will probably be completed in 1920, number 22, which compares with 16 projected for 1919, with 35 for 1918, with 72 for 1917 and 91 for 1916. The reason this year's program exceeds that for 1919 is that some of those scheduled for last year were postponed until 1920. The total estimated capacity of the furnaces projected for completion in 1920 is 875,000 gross tons. This compares with 1,130,000 tons planned for 1919, with 1,645,000 tons for 1918 and 4,515,000 tons for 1917. In both 1918 and 1919, in the list of furnaces under construction and projected, the Bethlehem Steel Corporation was credited with a duplexing plant at its Maryland Works at Sparrows Point, consisting of four 200-ton tilting open-hearth furnaces and four 25-ton Bessemer converters. In 1920 only one of the 200-ton tilting furnaces is reported as authorized for building in 1920.

New installations contemplated in 1920 by companies are as follows: Weirton Steel Co., Weirton, W. Va., seven 100-ton furnaces at a new plant at Toronto, Ohio; the Wayne Steel Co., Erie, Pa., two 30-ton furnaces; Lukens Steel Co., Coatesville, Pa., two 100-ton furnaces; Interstate Iron & Steel Co., Chicago, one 75-ton furnace; Atlantic Steel Co., Atlanta, Ga., one 50-ton furnace; Follansbee Brothers Co., Follansbee, W. Va., four 40-ton furnaces; Kansas City Bolt & Nut Co., Kansas City, Mo., two 50-ton furnaces; Drain Steel Co., Philadelphia, with plant at Moore, Pa., two furnaces (estimated), and Bethlehem Steel Corporation, one 200-ton tilting furnace at its plant located at Sparrows Point, Md.

The United States Steel Corporation does not report any additions to its melting capacity for 1920.

Expressed in a table, the proposed new open-hearth capacity for 1920 is as follows:

New Open-Hearth Furnaces Under Construction for 1920

	Number of Furnaces	Annual Capacity, Gross Tons
Independent companies	22	875,000*
United States Steel Corporation	0	.....
Total	22	875,000

*Includes the changing of a 60-ton to a 120-ton furnace by the Central Iron & Steel Co., Harrisburg, Pa.

A new Bessemer department is planned for construction in 1920 by the Steel & Tube Co. of America, but details are not announced.

New Blast Furnace Construction

The record of additions to pig-iron making capacity in 1919 is small compared with the expansion in either 1917 or 1918. Our data show only two blast furnaces to have been completed in 1919 as compared with eight in 1918 and 14 in 1917. The 1919 record is even smaller than that of 1916, when four were put in blast. The two furnaces completed in 1919 represent a capacity of 350,000 gross tons of pig iron.

For 1920 our statistics show that there are four blast furnaces under construction for probable completion this year. Three of these were listed as planned for completion in 1919; they are nearly finished and will probably be blown in early this year. The four new furnaces represent an estimated new capacity of 700,000 gross tons of pig iron per year. The following table gives details of new blast furnaces completed in 1919 and at present under construction:

Company:	Completed in 1919	Under Construction or Projected
Jones & Laughlin Steel Co., Pittsburgh	1	..
Weirton Steel Co., Weirton, W. Va.	1	..
Ford Motor Co., Detroit	..	2
St. Louis Coke & Chemical Co., St. Louis	..	1
Pittsburgh Crucible Steel Co., Midland, Pa.	..	1
Total	2	4

Several companies rebuilt and enlarged their blast furnaces in 1919 and plan to do so in 1920, materially increasing their capacity.

The Steel Corporation

New construction completed during 1919 and that under way as of January 1, 1920, by subsidiary companies of United States Steel Corporation, is as follows:

Carnegie Steel Co.

Completed

Edgar Thomson Works: Rebuilding blast furnaces E and F and improvements to crane equipment at No. 1 foundry and chipping shed.

Duquesne Works: Rebuilding blast furnace No. 4 and modernizing stock yard and charging system, rebuilding blast furnace No. 4 and building electrode factory at lower works.

Homestead Works: Equipping open-hearth plant No. 4 to burn tar and coke oven gas and installing additional reheating furnaces at 48-in. and 110-in. plate mills, as well as additional shearing equipment and extension of buildings at 84-in., 110-in., 128-in. and 140-in. plate mills.

Carrie Furnaces: Additions and replacements at blast furnaces Nos. 1 and 2.

Bellaire Works: A 1000-hp. boiler installation.

Farrell Works: Rebuilding blast furnace No. 3 and installing flue dust sintering plant.

Clairton Works: 128 additional by-product coke ovens. Coke oven, gas pumping station and pipe line to Homestead, Edgar Thomson and Duquesne works. Naphthalene refining plant. A 1500-hp. boiler installation at blooming mill boiler house.

Additional river craft were put in service for transporting coal to the Clairton by-product coke ovens and marine ways constructed on the Monongahela River at Coal Valley, Pa. Approximately 1500 houses for employees at various works have been completed or are being constructed.

Under Way

Edgar Thomson Works: Reconstruction of stock-yard bunker and larry system at blast furnaces and extending electric stock transfer system. Additions to crane facilities in Nos. 2 and 3 foundries and foundry roll and machine shop.

Duquesne Works: Rebuilding blast furnace No. 5.

Homestead Works: Seven 125-ton electric overhead traveling cranes to increase pouring capacity at open-hearth plants Nos. 2 and 3. New hydraulic pumps and pressure system at 32-in. slabbing mill to serve 32-in., 72-in., 84-in. and 140-in. mills and open-hearth plants Nos. 1 and 2.

Carrie Furnaces: A 15,000-kw. turbo generator complete with boilers and auxiliary facilities. Gas washing equipment at blast furnace No. 5. Additions and replacements to blast furnaces Nos. 3 and 4.

McDonald Mills: An 18-in. band mill.

New Castle Works: Three new hot blast stoves at blast furnace No. 1.

Clairton Works: Coal dock and coal storage facilities at Wilson Station. Concentrated ammonia plant.

Illinois Steel Co.

Completed

South Works: Remodeling blast furnace No. 8. Additional converter at duplexing and open-hearth plant. Four soaking pits and additions to heating facilities at slabbing mill. Billet dock for special steels and forging blooms.

Gary Works: Third furnace at duplexing open-hearth plant. Additions to electric power station No. 4. Tie plate department. Extending roll, machine and boiler shop buildings and additional shop equipment.

Under Way

South Works: A 300-ft. building over finishing end, two heating furnaces, cooling, shearing and shipping facilities at 90-in. and 132-in. plate mills.

Minnesota Steel Co.

Completed

Duluth Works: Addition to merchant mills. Manipulators on rail mill tables. A 25,000,000 gal. pump.

Under way

Duluth Works: Improvements to 28-in. mill. Plant for drying ammonium sulphate.

Plans are being drawn for wire rod and wire mills, on which work will begin in the spring of 1920. The cost will be $2,500,000 and upward. Other finishing mills will be built later, the total program, extending over four or five years, involving a $9,000,000 outlay.

The Lorain Steel Co.

Completed

Johnstown Works: New stoker and coal handling equipment at boiler house. Equipment to increase roll-making capacity.

National Tube Co.

Completed

Lorain Works: Additional ore bridge and extending ore trough and runway. Extending bloom, slab and billet storage yard. Finishing equipment for couplings.

National Works: Rebuilding blast furnace No. 4. New electric power plant, including 10,000-kw. turbo generator and steam boiler plant and auxiliaries. Scale removing equipment for butt weld mills Nos. 1 to 6.

Riverside Works: Additional blowing equipment for blast furnace No. 1 and Bessemer steel plant.

Ellwood Works: Extending 22-in. bar mill building and additional bloom heating furnace capacity.

Under Way

National Works: Rebuilding blast furnace No. 3. Additional cutting-off and threading equipment in lap weld mills.

Christy Park Works: Horn welding department for large sizes of pipe.

Pennsylvania Works: Equipment for finishing couplings.

Riverside Works: Scale removing equipment for butt weld mills Nos. 1 to 5.

Ellwood Works: Town site and 100 houses for employees, including bridge over the Connoquenessing River.

Gary Tube Plant: Self-contained tube plant, including four blast furnaces.

American Steel & Wire Co.

Completed

Newburgh Steel Works: Additions to 35-in. blooming mill.

Newburgh Wire and Cuyahoga Works: Equipping various departments to burn coke oven gas.

Donora Steel Works: Flue dust sintering plant.

Under Way

Cuyahoga Works: Additions to Nos. 1 and 3 strip mills.

Donora Steel Works: Installation of additional boilers in steam power plant.

American Sheet & Tin Plate Co.

Completed

Chester Works: Additional tin mill.

Cambridge Works: Additional tin mill.

Farrell Works: Rebuilding sulphate of iron plant. Extension to annealing building.

At various works nine scrap baling presses with auxiliary facilities were installed.

Under Way

Gary Works: 24 additional tin mills. Geared motor drives for eight sheet mills.

Vandergrift Works: Increasing handling facilities in open-hearth department. New pickling and galvanizing department buildings and equipment.

American Bridge Co.

Completed

Gary Works: Forging plant.

Ambridge Works: Water purifying plant.

Pencoyd Works: Water purifying plant. Additional boiler and stoker equipment at No. 2 boiler house.

Under Way

Trenton Works: New buildings and equipment to modernize plant. Equipment for producing fabricated steel for ships is being installed at several plants.

Universal Portland Cement Co.

Completed

Buffington, Ind.: Dust collecting system for dryers at mill No. 4.

Under Way

Universal, Pa.; Coal drying and pulverizing plant.

Tennessee Coal, Iron & Railroad Co.

Completed

Ensley Works: Improvements to blast furnace No. 5. Facilities for transferring hot metal from bessemer blast furnace No. 1. Equipment at open-hearth plant to facilitate triplexing process. Additions to electric power plant equipment, including 7500-kw. turbo generator.

Fairfield Works: Two additional soaking pits at blooming mill. Two additional reheating furnaces. Central hospital for Birmingham district.

Central Water Works: Additions to boiler plant.

Under Way

Ensley Works: Improvements to blast furnace No. 3

Fairfield Works: Fabricating plant for ship and car material. Gantry crane and runway.

By-Product Coke Plant, Fairfield: 154 additional by-product coke ovens. Enlarging benzol plant.

Federal Shipbuilding Co.

Completed

Two additional shipways. Additions to boiler shop.

Under way

Extension to copper and sheet metal shop.

Chickasaw Shipbuilding Co.

Completed

Shipbuilding plant of six ways.

Under Way

Town site, street railroad system, lighting plant and water works.

Canadian Steel Corporation, Ltd.

Under Way

New steel plant and town site at Ojibway, Canada.

Bethlehem Steel Corporation

The following is reported for the various plants of the Bethlehem Steel Corporation:

Bethlehem Plants, Bethlehem, Pa.

Completed in 1919: A 250,000 gallon fuel oil storage tank; boilers and equipment to No. 1 Boiler House; one 2,000 cu. ft. air compressor with motor; five saturators and equipment and additions to benzol plant.

Under Way: Additions to new 42-in. Bethlehem shape mill, additions to new 48-in. Bethlehem shape mill, equipment for new 42-in. Bethlehem shape mill; condensor pumps at river pumping station; three-high 28-in. billet mill; extension to warehouse at mill No. 2; extension of shipping and fabricating storage yard at bridge shops; extension to boiler house at Saucon plant; equipment for handling coke breeze at soaking pits; 25 Clarke side dump railroad cars; purchase of Shimersville school property; sand handling equipment for ingot mold foundry; additions to dolomite plant; new gas blowers for exhauster house.

Steelton Plant, Steelton, Pa.

Completed in 1919: Three 3000 k.w. gas electric generator sets and twenty dump cars.

Under Way: Electric motor drive for 44-in. blooming mill; 20 thirty yard extension side dump cars; new chemical and physical laboratory; bloom heating furnace for 28-in. rail, billet and structural mills; four additional Hughes gas producers for rail and structural mills; equipment for Sandberg system of air treating rails, 28-in. finishing mill.

American Iron & Steel Plant, Lebanon, Pa.

Completed in 1919: Steel, frame and brick building for engineering department; oil house and fuel oil storage; one Mansville cut threading machine.

Under Way: Addition to boiler house, including four 520 h.p. boilers, etc.; new factory warehouse and finishing department; new keg storage and copper shop, including galvanizing department; additions to wire drawing building, including new pickling department.

Maryland Plant, Sparrows Point, Md.

Completed in 1919: One-story office building; additional electric power; main trunk sewer at coke ovens and at blast furnaces; molding machines; continuous reheating furnace for 26-in. rail mill.

Under Way: New electrical repair shop; addition of 12 hot mills, with furnaces, shears and cold rolling mills, including annealing, pickling and tinning equipment; 8 sheet mills and two jobbing mills with furnaces, shears, cold rolling mills, including annealing, pickling, galvanizing, and corrugating equipment; one 200-ton tilting open-hearth furnace, including two-bay extension to open-hearth building; addition of 35-ft. leanto to present machine shop, including yard crane runway and crane; repair shop 40 ft. x 86 ft. for coke ovens; additional machine tools for machine shop; one 5-ton crane for iron foundry; one 15-ton crane for 40-in. blooming mill; equipment for shearing, conveying and loading billets; box plant and timber shed; 510 ft. of concrete trestle, including 348 ft. of timber approach trestle.

Midvale Steel & Ordnance Co.

At the Midvale Steel & Ordnance Co.'s works, Johnstown, Pa., the following additional facilities were completed during 1919:

An ore sampling house at Franklin blast furnaces; a gas producer at blooming mill; a 1500-ton gas coal bin at Franklin; a water recovery, water circulating and quenching system at the coke plant; new screening mechanism at Franklin coke plant; new coke quencher car and four old quencher cars rebuilt and new die sinking machine at car shop. Additional machine tools were installed at the wheel plant; additions made to mixer house at pig casting plant; additional boilers at rod and wire mill boiler house; two turbo blowers at Nos. 1 and 4 blast furnaces; five blast furnaces relined and repaired; breeching at Nos. 5 and 6 blast furnace boiler houses; pumping station at Coopersdale; new disc spinning machine installed; new oil-burning system for furnaces in rake, disc and smith shops; electrification of fourth left heading and Mill Creek sections of rolling mill mine; airshaft at Elk Run; new air reduction plant; purchase of five dwellings at Westmont for vice-president and superintendents; 42 dwellings at wheel plant; five dwellings at rolling mill mine; five dwellings at Franklin mines Nos. 3 and 4; 25 additional dwellings at Saltsburg; three new mining machines and 300 mine cars for Saltsburg mine.

The following improvements are in progress in 1920:

New rumblers and keg shaking device for wire mill; new steam blowing engines at Nos. 1 and 4 blast furnaces; three new hot stoves at No. 5 blast furnace; two new gas cleaners at Nos. 5 and 6 blast furnaces; 24 hot metal ladles; ore sampling house at Nos. 1 and 4 blast furnaces; changes to tilting rig at Cambria pig-casting plant; changes to Bessemer hot metal hoist; new pickling shed; new rail anchor shop at Gautier; new skull breaker at Williams Farm; ten 45-ton hot metal ladles for Franklin open-hearth plant; installation of four new stock-yard cranes; a new charging machine at Franklin open-hearth; 80 charging box cars; installation of new 75-ton ladle crane; new ingot stripping plant; alterations to 32-in. blooming mill; new sewer system at Franklin open-hearth; ore and limestone bins for loading charging boxes at Franklin open-hearth; 51 new gas producers; two heating furnaces at plate mill; screw down and pinions for 40-in. blooming mill; new gas line from Nos. 9 and 10 blast furnaces and 12-in. coke line to Nos. 10 and 11 boiler houses; new foul gas and tar lines at Franklin coke plant; new gas ignition system for blowing engines at Nos. 7 and 9 blast furnaces; new coke handling system at Franklin blast furnaces; reinforcing Franklin open-hearth floor; loam trolley at coke plant; two 12,000-gal. water storage tanks at coke plant; 5-in. bolt cutter at Franklin bolt shop; new scrap shear and roller run at Williams Farm; eight 977-hp. boilers at Franklin mills boiler house; stock bin changes at Franklin blast furnaces; new gas and air valves at Franklin open-hearth furnace; lavatory and comfort station at structural shop; relining Nos. 10 and 11 blast furnaces; new lavatory for Nos. 1 and 2 coal mines; further electrification of rolling mill mines; continuation of improvements at Saltsburg; new mine opening at Rosedale; new air shaft at rolling mill mine; new hospital building; addition to general office; 40 additional dwellings near wheel plant; office and 20 additional miners' houses at Saltsburg.

At the Coatesville works, Coatesville, Pa., the following additions were completed in 1919:

Eight automatic stokers at No. 4 boiler house; deep throat hydraulic plate shear at No. 4 plate mill; new press in flanging department; new building over viaduct bar mill; coal trestle at open-hearth No. 1; gas producers rebuilt; additional property purchased for slag disposal and community garage on town site property.

In addition there is in progress for completion in 1920:

New locomotive repair shop, dam and spray system for water supply at Brandywine works; motor drives to replace steam on plate mill tables; additional soaking pit at No. 4 plate mill; relining top portion of No. 3 blast furnace; new special steel treating plant; relocating and modernizing skelp mill; ladle house at blast furnaces and electric locomotive for tube mill.

At the Nicetown plant, Philadelphia, the open-hearth furnaces have been altered to burn fuel oil. One 6-ton Heroult electric melting furnace with equipment is in process of installation. Alterations are in progress at the casting plant and the rolling mill is undergoing rearrangement.

Republic Iron & Steel Co.

New additions and improvements made by the Republic Iron and Steel Co. at its plants in the Youngstown and Haselton, Ohio, districts, also at New Castle, Pa., and Niles, Ohio, during 1919, and new work contemplated for 1920 is as follows:

At the Bessemer and Brown Bonnell departments, Youngstown, Ohio, there was installed in 1919 a drinking water purification and cooling plant with distributing lines.

At the open-hearth plant at Youngstown, Ohio, there was installed in 1919 a crane in the 40-in. blooming mill building, a 1500-hp. feed water heater in the blooming mill engine house, and additional tools in the machine shop. A roll shop with complete equipment, including cranes, etc., a millwrights' and electricians' building, an extension to the office building, open-hearth superintendent's office and the drinking water purification and cooling station with distributing lines were completed.

At the by-product coke works, Youngstown, the enlargement of the coal storage bin, equipment for

handling sulphate, hoist for luting clay, storage for coal, elevator, stoker at boiler No. 6, addition to the office building, installation of an air compressor and additional double pipe coolers and secondary light oil condensers were completed in 1919.

At the Haselton blast furnaces, Youngstown, Ohio, in 1919, the company relined No. 2 furnace, increasing its inside dimensions and changing it from a hand-filled to a skip-filled furnace, altered the bins and added larry cars for handling the material from the bins to blowing engines Nos. 11 and 12, with condensers and other equipment, were installed in No. 2 blowing engine house and a 1500-cu. ft. air compressor in the electric power house. Boiler house No. 4 was equipped with four 1130-hp. stoker fired boilers and forced and induced draft fans, economizers, coal and ash-handling equipment, etc., were also completed. Additional boiler feed and service pumping capacity was provided. Connections were made to the drinking water purification and cooling station on the open-hearth side of the river, and piped to various buildings at the Haselton furnaces. In the early part of 1920 the No. 3 turbo blower installation for supplying air to blast furnaces No. 1 and No. 5, including the enlargement of the present turbo blowing engine house and the addition to auxiliary equipment will be completed. An electric truck equipment for handling ore at No. 1 furnace has been purchased for early installation.

At the tube works located at Youngstown in 1919 a ball conveyor was installed at the 8 to 16-in. lap weld mill, and a building for millwrights and electricians and one for housing an air compressor were completed. A drinking water purification and cooling plant was provided and equipment for manufacturing English thread pipe was installed. In the early part of 1920 the coupling shop will be enlarged and the coupling and tapping equipment considerably increased. A storage building for commissary and billeting equipment will be erected.

At the Atlantic furnace, Newcastle, Pa., a single strand pig casting machine with the necessary accessories will be installed in 1920.

In 1919 the Deforest Sheet and Tin Plate Works, consisting of 10 hot mills, five cold mills, a galvanizing department, etc., was purchased. The mill drive has been changed to an electrically operated one. There has been added a new substation, the mill foundations have been rebuilt and squaring shears, machine tools, warehouse heating equipment, etc., added.

At the Russelton coal mine No. 1, in 1919, the wooden tipple was replaced with a modern steel one, the hoist house remodeled, electric driven hoists installed, the shaft concreted and new pumping equipment installed.

The six-story general office building at Youngstown is now being enlarged by adding 30 ft. to its length and building two additional stories over the old and new parts, thereby increasing the floor space about 65 per cent.

Central Iron & Steel Co.

The Central Iron & Steel Co., Harrisburgh, Pa., states that in 1919 No. 1 open hearth furnace was reconstructed and enlarged from 60 to 120 tons capacity, and a similar program is under way for No. 2 furnace. When completed the open hearth department will consist of four 120-ton and two 60-ton furnaces.

To relieve the congestion in the shipping shed of the 126-in mill this building has been extended 126 ft., increasing the piling space for plates about 100 per cent and, to augment the inadequate heating capacity and produce a saving of fuel, a narrow and broad gage track system has been installed from the furnace house which permits the transfer of hot steel from the open hearth direct to the heating furnaces.

The 89-in. mill engine, which was too small, has been replaced by a larger one so that the mill is now capable of increased tonnage. The universal mill heating capacity has been increased by four producers and three soaking pits.

A complete fuel-oil system has been installed for use in the mills and open-hearth so that they can now be run on either coal or oil. All of the mill equipment has been completely overhauled and put into condition to meet heavy tonnage demands.

Particular attention has been paid to the safety and welfare of the employees and chief among the items which have been instituted is a group insurance system.

Jones & Laughlin Steel Co.

The Jones & Laughlin Steel Co., Pittsburgh, completed and put in operation at its Aliquippa, Pa., works in the summer of 1919, a 600-ton blast furnace which gives the company five stacks of that capacity at Aliquippa. Minor improvements and additions were also made at the Aliquippa works. In Soho, Pittsburgh, this company completed four of the five units of Koppers by-product coke ovens on which it started work early in 1919. Each of these units contains 60 Koppers ovens and when the entire plant is completed, it will have a daily capacity for carbonizing 5400 tons of coal. The plant also has a complete by-product recovery installation with a daily capacity of 130,000 lb. of sulphate of ammonia and about 54,000 gal. of tar. The fifth unit of this plant will be completed and put in operation early this year. When completed and in full operation, this coke plant will have a capacity for making about 30,000,000 cu. ft. of gas per day, which will be utilized for heating purposes in the Soho and South Side mills of the Jones & Laughlin Steel Co., and will also have a daily capacity for making about 16,000 gal. of benzol.

Inland Steel Co.

The Inland Steel Co., Chicago, completed and put into use in 1919, thus indirectly increasing its producing capacity:

One 700-ton mixer.
Oil storage tanks with a capacity of 500,000 gal.
Two continuous reheating furnaces for the 28-in. mill.
A finishing bay, 90 x 800 ft., for the 20-in. mill.
Two 10-ton cranes for the 20-in. mill.

In 1920 the company will have equipment, installed and ready for use, for rolling and finishing standard railroad rails, as well as a splice bar finishing department. Both the rails and the splice bars will be rolled on the 28-in. mill. Arrangements have been made for a powdered coal installation for the heating furnaces which will take care of the 24-in. structural mill, the sheared plate mill and part or all of the sheet mills. The company will add 27 cars to its general service railroad cars for inter-works use, two 15-ton cranes and a finishing bay, 90 x 560 ft., for the 28-in. mill.

Allegheny Steel Co.

The Allegheny Steel Co., Pittsburgh, whose open-hearth steel plants and finishing mills are located at Brackenridge, Pa., added during 1919 two 30-in. hot mills to its sheet rolling department, but made no addition to its steel making capacity. On account of the very high Federal taxes and certain labor conditions, this concern has not made any plans for extension to its plant this year.

Youngstown Sheet & Tube Co.

The Youngstown Sheet & Tube Co., Youngstown, Ohio, whose blast furnaces, open-hearth and Bessemer steel plants and finishing mills are at East Youngstown, states that the only extension of any note it made during the year of 1919 was the installation of a Heyl-Patterson-Uehling double strand pig casting machine at its Hubbard furnaces at Hubbard, Ohio. The company has started the erection of an additional lap weld tube roll, designed to roll large sizes of pipe, and having a capacity of about 5000 tons per month. Foundations for this mill are pretty well along and it is expected that production can be started about July 1, next. In connection with its housing proposition, the company has erected about 100 new houses. Some of these are at Loveland Farms, some at East Youngstown and some at Highview.

Weirton Steel Co.

The Weirton Steel Co., whose blast furnace, the open-hearth steel plant now building, tin plate, hot and

cold rolled strip and other mills are located at Weirton, West Va., completed and put in operation on July 20 last year a 600-ton blast furnace for making basic iron, the furnace being 22-ft. 6-in. in diameter x 92-ft. high. New capacity now under construction by this company and likely to be completed in the late summer, this year, includes seven 100-ton basic open hearth furnaces, six 4-hole pit furnaces, one 40-in reversing blooming mill, one 4-stand continuous 21-in. roughing mill, one 6-stand continuous 18-in. sheet bar and billet mill. This new steel plant is expected to have an annual capacity of about 400,000 tons, to consist of 60,000 tons of slabs, 100,000 tons of blooms and billets and 230,000 tons of tin plate bars.

Lukens Steel Co.

The Lukens Steel Co., Coatesville, Pa., in 1919 put in operation six 100-ton open-hearth furnaces built in 1918, but the two 100-ton furnaces contemplated for erection in 1919 are not finished. These are about one-half completed and will probably be finished in 1920. The 204-in. mill was put in operation in 1919.

Pittsburgh Steel Co.

The Pittsburgh Steel Co., Union Arcade, Pittsburgh, with mills at Monessen, Pa., did not make any additions to its plant in 1919, and has no plans under way at present for any new construction during the early part of 1920. However, this company bought in 1919 the large coal holdings of W. Harry Brown in the Connellsville region and has now under way a scheme for the delivery of all its coal and coke from its mines and ovens in the Connellsville region to its mills and blast furnaces at Monessen by river and expects to complete this work early this spring. Requests for permits for the construction of the necessary docks, etc., have been presented to the War Department, but as yet the permits have not been issued. As soon as these are secured, the company will begin work at once on the building of the docks and other necessary equipment for the transportation of all its coal and coke by river. Some entirely new transportation ideas will be used in this project.

Colonial Steel Co.

The Colonial Steel Co., Pittsburgh, made no additions to its works at Colona, Pa., but built during 1919 new warehouses at Toledo, Ohio, and New Haven, Conn., and also installed a complete steel hardening plant in Detroit. The company has some tentative plans under way for additions to its plant in 1920.

Whitaker-Glessner Co.

The Whitaker-Glessner Co., Wheeling, W. Va., completed in 1919 a sheet mill plant at Beech Bottom, W. Va., containing eight hot sheet mills and added seven hot sheet mills at its Portsmouth, Ohio, works. The company now has under construction an 18-in. continuous billet and bar mill at Portsmouth, which will be finished in about six months. This company has no plans under way at present for additions during this year.

Sharon Steel Hoop Co.

The Sharon Steel Hoop Co., Sharon, Pa., built and put in operation during 1919 a new open-hearth plant at its Lowellville, Ohio, works, containing two 75-ton open-hearth furnaces, one 34-in. reversing blooming mill, and a 21-in. Morgan continuous mill. Other minor additions and improvements were also made to the plants of this company at Sharon, Pa., and Lowellville. The company states that at this time it has no additions or improvements contemplated for 1920.

LaBelle Iron Works

The LaBelle Iron Works, Steubenville, Ohio, has now under way additions to its plants at Steubenville, Ohio, as follows: For its tube mills a structural steel warehouse extension 80 x 120 ft., and a structural steel mill building extension 120 x 140 ft., a structural steel mill building extension 75 x 160 ft., brick and steel warehouse extension 75 x 80 ft., the latter two extensions being in its sheet mill department. The company is also electrifying eight hot sheet mills, and is installing a 2500 h.p. motor, is also electrifying seven cold mills, installing a 750 h.p. motor, and is rebuilding its sheet and pair furnaces. Other additions under way by this company include a steel and brick blacksmith shop 45 x 120 ft., and a slag crushing and sizing plant.

John A. Roebling's Sons Co.

The John A. Roebling's Sons Co., Trenton, N. J., completed in 1919 a new 35-in. three-high blooming mill and added two 40-ton open-hearth furnaces to its steel mill. Additional fuel oil storage and additional wire drawing and rope making machinery, as well as new equipment in the insulated wire department, have also been completed. There have also been installed cranes, trucks, tractors, and other labor saving devices for handling material. For 1920 extensions have not been authorized at this time, but further additions are contemplated.

Utah Steel Corporation

The Utah Steel Corporation, Salt Lake City, Utah, in 1920 will make the following improvements in its rolling mill department: The installation of an oil-fired continuous billet heating furnace to take the place of two coal-fired furnaces in use at the present time, serving its 10-in. and 16-in. finishing mills; the installation of an 8-in. motor-driven finishing mill and the extension of the mill buildings to provide room for an additional hot bed for the 8-in. mill and additional warehouse space for stocks. An electric overhead 5-ton traveling crane will be installed in the shipping department. While no enlargements are to be made in the open-hearth department the company will soon use fuel oil instead of producer gas in this department.

Interstate Iron & Steel Co.

The Interstate Iron & Steel Co., Chicago, in 1920 will erect and put in operation an additional 75-ton open-hearth furnace with an estimated annual capacity of 40,000 tons of ingots. It will also install one 12-in. and one 14-in. Morgan continuous bar mill with an annual capacity of 75,000 tons.

Atlantic Steel Co.

The Atlantic Steel Co., Atlanta, Ga., in 1920 will install one additional 50-ton basic open-hearth furnace, making the total number of furnaces in operation this year four, each of 50-ton capacity. The new furnace is expected to increase the annual output approximately 25,000 tons.

Laclede Steel Co.

The Laclede Steel Co., Alton, Ill., has now under construction an addition to its cold rolled steel strip department which will increase the capacity 1500 tons per month. The company is also making extensive improvements to the hot bed and shipping departments of the 8-in. and 10-in. hot-rolled steel strip mill.

Steel & Tube Co. of America

The Steel & Tube Co. of America, in 1919 put into operation at Indiana Harbor, Ind., two lap mills, and has the third lap mill under construction, which will be placed in operation Jan. 1, 1920. The coke plant adjacent, consisting of 120 by-product ovens, was purchased from the By-Products Coke Corporation and put into operation the latter part of August, 1919. Plans are being made for the construction of a new Bessemer Department in 1920.

At its Mayville, Wis., plant, formerly the Northwestern Iron Co., the company in 1919 increased the height of its B blast furnace and equipped it with a skip hoist and accessories. At its coke works there was installed one new coke grizzly, one 500 h.p. Sterling boiler equipped with a Harrington stoker and a new water softener for the boiler plant. The company completely rebuilt its No. 1 coke-oven battery. In 1920 the company contemplates for its coke plant additional light

oil scrubbers, storage tanks, oil cooling apparatus, additional Harrington stokers and a new coal handling plant.

Tacony Steel Co.

August, 1919, marked the consolidation of the Tacony Steel Co. and the Tacony Ordnance Corporation, both at Tacony, Pa., and the operation of the combined plants under the name of the Tacony Steel Co. The Tacony Ordnance Corporation, a modern and self-contained plant, was built during the war to manufacture gun forgings. It embraced acid open-hearth furnaces, 2000-ton and 1000-ton forging presses, heat-treatment plant and a large machine shop containing over 100 motor driven boring and turning lathes ranging up to 48 in., planers, etc.

The Tacony Steel Co., formerly known as the Philadelphia Steel and Forge Co., consisted of rolling mills which were particularly adapted to the making of special sections and the highest grade of alloy bar steels.

The present plant of the Tacony Steel Co. covers approximately 50 acres and contains acid open-hearth furnaces, forging presses, rolling mills, heat-treating facilities, machine shops, chemical, physical and microscopical laboratories, etc. During the past year some of the older buildings of the original plant were remodeled and a 100-ft. extension was put on No. 2 forge shop. The company owns considerable available land, and has under consideration certain plans for expansion which are not yet ready for announcement.

Nagle Steel Co.

The Nagle Steel Co. at its Rahway works, Rahway, N. J., has razed and reconstructed the stock buildings and has now under construction a gantry crane and an ingot stripper.

At its Pottstown works, Pottstown, Pa., the company has installed a new set of 72-in. straightening rolls and has under construction a 6-ton electric crane and runway to serve this mill. The large garage for the storing of automobiles for employees has also been built.

At its Seifert works, Seifert, Pa., the company has changed a 66-in. two-high plate mill to a three-high mill and has made an addition to its shipping department. It has in process of construction a 5-ton electric crane and runway. New lavatories have also been built.

Andrews Steel Co.

The Andrews Steel Co., Newport, Ky., in 1919 completed and put in operation two 100-ton basic open-hearth furnaces, five Morgan gas producers and additional coal crushers and handling machinery. There was also erected two 1000-h.p. boilers, stokers, etc.

Page Steel & Wire Co.

The Page Steel & Wire Co., Union Arcade, Pittsburgh, mills at Monessen, Pa., completed in the early part of 1919 the erection of Morgan mechanical gas producers in its open-hearth steel plant, formerly supplied with natural gas, and also completed installation of boiler house, over feed stokers operated with modern forced draft. The company gives the cost of the installation of the Morgan producers as $175,000 and the boiler house stokers as $75,000.

Apollo Steel Co.

In 1919 the Apollo Steel Co., Apollo, Pa., makers of black and galvanized sheets, added two new 30-in. hot sheet mills and one additional galvanizing pot for galvanizing sheets. This concern has quite a large addition to its plant in prospect, but plans have not yet been made. It is not likely work on this new addition will start early this year.

Wayne Steel Co.

The Wayne Steel Co., Erie, Pa., during the past year practically completed a new open-hearth steel plant which it expects to place in operation about Feb. 1. This is equipped with two 30-ton open-hearth furnaces. This company early in the year plans to remodel the rolling mills of the United States Horse Shoe Co., Erie, Pa., a subsidiary, which will consume a large part of its product. The horse shoe plant will be equipped to handle steel and two continuous furnaces and hot beds will be installed. An electric drive for mills will also probably be put in.

American Rolling Mill Co.

The American Rolling Mill Co., Middletown, Ohio, has increased its finishing capacity and is now installing 12 new sheet mills with the necessary power and other equipment. The additional capacity will be ready for operation about July 1.

McKinney Steel Co.

The McKinney Steel Co., Cleveland, completed its original building program by placing in operation early in the year two 100-ton open-hearth furnaces, the erection of which it started late in 1918. The company's plant now has 14 open-hearth furnaces.

Canton Sheet Steel Co.

The Canton Sheet Steel Co., Canton, Ohio, during 1919 replaced two old 30-ton open-hearth with 80-ton furnaces and added an 18-in. continuous bar mill. The company now has four 80-ton furnaces and a three-high continuous bar and billet mill for rolling sheet bars and billets and its new 18-in. mill.

Otis Steel Co.

The Otis Steel Co., Cleveland, is rebuilding its No. 1 blast furnace, this being one of the two furnaces of the Cleveland Furnace Co. which was merged recently with the Otis company. The hearth is being enlarged to 18 ft. 6 in., the bosh is being made larger, and the lines of the furnace are being changed. The rebuilt furnace will have a daily capacity of 550 tons as compared with the old furnace capacity of 400 tons.

Crucible Steel Forge Co.

The Crucible Steel Forge Co., Cleveland, installed during 1919 a 6-ton Heroult electric furnace, and will shortly add another Heroult furnace of 1-ton capacity. It also added heavy cogging equipment, six heating furnaces, three waste heat boilers and additional heat treating, annealing and straightening equipment. A building 60 x 260 ft. was erected to house the cogging equipment. The company has placed a contract with Mackintosh, Hemphill & Co. for a 16-in., a 10-in. and an 8-in. heavy type mill for production work. These will be located in a new building 60 x 900 ft., contract for which has been placed. Three reheating furnaces will be installed in the mill building. The company will manufacture special alloy steel bars and billets and tool steel. It expects to have its complete plant ready for operation during the summer.

Follansbee Brothers Co.

The Follansbee Brothers Co., which has an open-hearth steel plant, sheet and tin plate mills at Follansbee, W. Va., has plans under way for construction in 1920 of the new open-hearth steel plant containing four 40-ton furnaces and 10 sheet mills at Toronto, Ohio, about eight miles north of Steubenville.

Pittsburgh Crucible Steel Co.

The Pittsburgh Crucible Steel Co., Midland, Pa., a subsidiary of the Crucible Steel Co. of America, expects to blow in early in 1920 its new 600-ton blast furnace and to start up the additional 100 Koppers by-product coke ovens. A new electric coal hoist is being built to handle coal shipped from the company's mines on the Upper Monongahela River. The company is also installing a Wellman-Seaver car dumper and will equip its power house with a 10,000-kw. General Electric turbo generator. An Otis electric elevator is being installed in connection with the new blast furnace stoves so that the men can go to the top of either furnace

without using stairways. A Kling-Weidlein dry gas cleaner is being put in. The blast furnace and the three two-pass stoves are being built by the Riter-Conley Mfg. Co.

Kansas City Bolt & Nut Co.

The Kansas City Bolt & Nut Co., Kansas City, Mo., late in 1919 commenced the construction of a new steel mill containing two 50-ton open-hearth furnaces. Part of the output of ingots from these furnaces will be rolled down to billets on a 22-in. mill, also in the course of construction. These billets will be finished on the company's present 16 and 10-in. mill into bolt and nut stock and merchant and reinforcing bars. The remainder of the ingot output will be finished on the 22-in. mill into larger bars, structural shapes and billets for the general market. As soon as the two open-hearth furnaces referred to are in operation in 1920 the company plans the construction of a third furnace and the plant is so laid out that a fourth and fifth furnace may be added if conditions warrant it. The first two furnaces are expected to be in operation by April 1.

The American Rolling Mill Co., Middletown, Ohio, increased its capital stock in July, 1919, to cover the erection of eight sheet mills and one jobbing mill at its East Side works at Middletown.

The Donner Steel Co., Buffalo, in 1919 acquired title to the two blast furnaces of the Tonawanda Iron & Steel Co., Tonawanda, N. Y., which it has been leasing for the last three years. With the acquisition of these two furnaces the Donner Steel Co. now owns four blast furnaces.

Union Steel Casting Co.

The Union Steel Casting Co., Pittsburgh, took advantage of the period of reduced operations in the first half of last year, and rebuilt a charging platform and the building over the two open-hearth furnaces in its No. 1 plant; a three-ton high type floor charging machine made by the Alliance Machine Co., Alliance, Ohio, has also been installed. This addition, together with minor ones, puts the No. 1 open-hearth plant in first-class condition. This is the original open-hearth plant, while its No. 2 open-hearth plant is of slightly larger capacity, and was built in 1911. These two open-hearth plants give this company a capacity for turning out 3300 tons of steel castings per month and 1000 tons of chill and sand cast ingots for forging purposes.

Reading Steel Casting Co.

The Reading Steel Casting Co., Reading, Pa., during 1919 constructed and placed in operation a new machine shop at a cost of $250,000. It has also spent $80,000 on the installation of labor-saving devices, most of which are now in operation. It is rebuilding one 10-ton acid open-hearth furnace, changing it to a 20-ton furnace, thus furnishing the company with two 20-ton furnaces. The new furnace will be in operation early in 1920. These furnaces, in addition to the four converters which it has operated for some time will bring the monthly capacity of the plant to about 2000 tons of finished castings per month.

Carbon Steel Co.

The Carbon Steel Co., Pittsburgh, plans to discontinue its present forge shop early in this year, and will utilize the space it now occupies for the installation of several new mills, the exact types of which have not been fully determined. This company made some minor additions to its plant during 1919, but its plans for new mills and other additions and improvements during 1920 are quite comprehensive.

Witherbee, Sherman & Co.

Witherbee, Sherman & Co., New York, reports that as to mining operations only the three old mines, Old Bed, Harmony and New Bed have been operated in 1919 with production for year approximately 920,000 tons. Diamond drill exploration to extent of 2000 ft. ahead of these ore bodies and also on a new low phosphorus territory were completed, but mine operations cut to one shift on April 1, 1919.

In concentrating operations a change was made in the No. 4 mill working on low phosphorus ore, by which approximately two-thirds of the output may be produced as special low phosphorus ore running 0.010 per cent to 0.012 per cent phosphorus, and 66 per cent iron. An underground tunnel with draw-off was installed at No. 3 mill for stocking crushed rock in different sizes. The new storage and transfer dock at Port Henry has been completed. Ore was regularly transported from Port Henry to Elizabethport, N. J., by the company's fleets during the last half of the season.

The Port Henry furnace, for many years under lease to the Northern Iron Co., was taken over on April 1, the furnace relined and repaired, an extra turbo blower installed and furnace blown in Oct. 6, a single strand pig-casting machine installed and put in operation the middle of December.

The company has purchased a tract of land on the Hudson River in Albany, and plans are now being completed for the erection of a mill for the manufacture of the company's fertilizer, barium phosphate.

OTHER STEEL WORKS ADDITIONS

The Wisconsin Steel Co., Chicago, in 1919 added two batteries of 88 ovens to its by-product coke plant.

The Penn Steel & Iron Corporation, Lancaster, Pa., is planning to erect in 1920 a 10-in. tandem guide mill.

The American Steel Foundries, Chicago, in 1919 purchased the exclusive right for steel foundry uses of the Beardsley & Piper centrifugal sand slinger for ramming molds.

The Eagan-Rogers Steel & Iron Co., Crum Lynne, Pa., in 1919 put into operation a new machine shop equipped with the latest machine tools for furnishing to customers completely machined steel castings. In 1920 the company proposes to enlarge this machine shop and also to make an extensive addition to its foundry building so as to almost double the capacity.

The Mahoning Valley Steel Co., Niles, Ohio, is installing two galvanizing pots for galvanizing light sheets which will be ready for use early this year. No additions to the mill equipment were made in 1919.

The Drain Steel Co., Moore, Pa., whose temporary address is Perry Building, Philadelphia, was organized in September, 1919, for the manufacture of carbon and alloy steel. The company expects to have the first unit of its plant in operation some time in 1920 with basic open-hearth steel capacity of about 75,000 tons per year. The number of open-hearth furnaces under construction is not given nor are plans fully matured as to further increases in 1920.

The United Steel Co., Everett, Wash., is constructing a 12-in., five-stand, three-high merchant bar mill which will be put in operation early in 1920.

NEW ROLLING MILL WORK

Enlargement of rolling mill capacity in the United States in 1919 was not extensive.

Reading Iron Co.

The Reading Iron Co., Reading, Pa., last August acquired the George B. Lessig Co.'s plant at Pottstown, Pa., which comprises a puddle mill having 22 double puddling furnaces with a two-high muck mill of three trains of rolls. This plant also has one plate mill, a three-high 22-in. train of rolls for nail skelp with two heating furnaces, one nail factory of 105 cut nail machines for wrought iron cut nails, and the necessary auxiliary equipment, including a machine shop and other departments. The acquisition of this plant increases the Reading Iron Co.'s muck bar capacity by 2500 gross tons per month. The cut nail capacity is 15,000 kegs per month.

The company also purchased in December the puddle and skelp mill and the nail factory of the E. & G. Brooke Iron Co., Birdsboro, Pa. This plant consists of 16 double puddling furnaces, a three-high double puddle bar mill, a 24-in. three-high skelp mill with four

heating furnaces and a nail factory having 75 nail machines. There is a galvanizing plant for galvanizing nails and a cooperage shop in connection with the nail factory.

In 1919 the company relined both of its blast furnaces and has also made minor improvements to its rolling and tube mills as well as to its blast furnace.

In 1920 the company will install a new 18-in. grooved mill for pipe skelp at its Montour plant, Danville, Pa. It will have a capacity of 130 gross tons per 24 hr.

McKeesport Tin Plate Co.

The McKeesport Tin Plate Co., McKeesport, Pa., completed in 1919 a modern boiler house, equipped with twelve 606-hp. Ladd vertical water tube boilers, equipped with Sanford-Riley stokers. Some construction out of the ordinary was used in the building of this boiler house.

Newton Steel Co.

The Newton Steel Co., Newton Falls, Ohio, was organized in 1919, and is now erecting a plant for the manufacture of automobile sheets. It will have eight finishing mills with an annual capacity of 48,000 tons of finished product. It is expected that the plant will be ready for operation about March 1.

Superior Sheet Steel Co.

The Superior Sheet Steel Co., Canton, Ohio, organized late in 1919, has now under construction a plant which will be equipped with eight sheet mills and will have cold rolling, annealing and galvanizing departments. The unit now being erected will have an output of approximately 60,000 tons of sheet steel per year. The company has acquired a building site of sufficient size to take care of large extensions.

Mansfield Sheet & Tin Plate Co.

The Mansfield Sheet & Tin Plate Co., Mansfield, Ohio, is installing four new sheet mills which are expected to be ready for operation in March. With the additional mills the company will have an annual output of about 80,000 tons of finished sheet steel.

OTHER NEW ROLLING MILL WORK

The Aetna Iron & Steel Co., Gary, Ind., bought in 1919 about 400 acres on which a new steel plant is being constructed. The new works, which will ultimately consist of four units, will contain in the first unit, 88 ft. x 552 ft., six sheet mills, and will be equipped with two 30-ton cranes. Besides this there will be a furnace building, 43 x 552 ft., an annealing, galvanizing and warehouse building, 84 x 625 ft., equipped with a 30-ton crane, and a shipping building, 30 x 500 ft.

The Onondaga Steel Co., Syracuse, N. Y., has several additions to its plant under way or authorized. They include an annealing department, 40 x 160 ft., an 80-ft. extension to the mill building, and several smaller buildings. During 1919 a new electric steel furnace of special design was placed in operation.

The Detroit Seamless Steel Tubes Co., Detroit, late in 1919 began the construction of a plant on a 60-acre tract. The new building, 350 x 700 ft., will consist of three bays for manufacturing units. A powdered coal system will be used for all heating and annealing processes. The total capacity of the first unit will be 2500 tons of seamless steel tubing per month, ranging in size from ½ in. to 6 in. outside diameter, and No. 13 gage and heavier. Cold-drawn seamless steel boiler tubes and locomotive flues will be produced, as well as mechanical tubing for automobiles, tractors and trucks.

The Clinton-Wright Wire Co., Worcester, Mass., which is a result of the merger of the Wright Wire Co., the Morgan Spring Co. and the Clinton Wire Cloth Co., about the middle of 1919 plans large additions to its wire mills at Palmer, Mass. This is expected to add about 10,000 tons per year to the capacity and to care for the needs of the Clinton Wire Cloth plant which hitherto has bought its wire in the market. It is probable that an additional mill will be erected some time in the near future.

The Scullin Steel Co., St. Louis, has started the installation of a rolling mill at the east end of its steel-casting plant on Knox Avenue. The six 30-ton open-hearth furnaces which have been idle since it completed its munition contracts will be used in connection with this plant. The plant will include both structural and bar mills and continuous heating furnaces, oil fired, will be installed. Structural shapes and bars will be rolled on a 22-in. mill of four stands, three rolls high. A five-stand 12-in. mill, preceded by a two-stand 16-in. rougher will roll the smaller merchant bars from reheated billets. The 22-in. mill building will have a span of 76 ft. and a length of 487½ ft. The 12-in. mill building is 75 ft. 6 in. x 500 ft. The two buildings are separated by 60 ft., to be used for the storage of billets, etc. The capacity of the plant will be 9000 to 10,000 tons of ingots per month.

The Wyckoff Drawn Steel Co. was incorporated in the late summer of 1919 and has secured a site of 12 acres at Economy, Pa. A new rolling mill is being erected to produce rounds, flats, squares, hexagons and special shapes of both carbon and alloy steel, and also turned and drawn shafting.

The Universal Rolling Mill Co., Bridgeville, Pa., has changed its name to the Universal Steel Co. and the capital stock has been largely increased. The enlarged company has acquired all the assets of the Hussey-Binns Steel Co., Charleroi, Pa., which will hereafter be known as the Charleroi plant of the Universal Steel Co.

George W. Armstrong & Co., Inc., Fort Worth, Tex., added in 1919 an oil well supply department involving an investment of about $100,000 for the manufacture of oil well supplies, such as sucker rod, pull rods, anchor and casing plant and various other iron and steel products.

The Ludlum Steel Co., Watervliet, N. Y., in 1919 erected one new six-stand 9-in. merchant mill and added about 20 per cent to its annealing capacity. Shipping, inspection and stock rooms were also built.

The Glasgow Iron Co., Pottstown, Pa., is rebuilding its muck bar mill, which it hopes to have in operation in the near future.

The National Rolling Mill Co., Vincennes, Ind., has contracted for a steel yard building, 80 x 260 ft., to be equipped with electric cranes for handling scrap iron and finished material. It is expected that this will be ready for operation by Feb. 15. After the completion of this contract the company expects to install one or two other units of the same size.

The Fort Wayne Rolling Corporation, Fort Wayne, Ind., in 1919 equipped its 9-in. mill with motors, and is now installing a 500-hp. motor to operate this equipment.

BLAST FURNACE WORK

The Ford Motor Co., Detroit, has completed two 500-ton blast furnaces, which will be put into operation early in 1920, with an output of 1000 tons per day. To take care of the operation of these furnaces there has also been completed the necessary ore, limestone and coke storage yards, docks, unloading equipment, ore bridges, etc. In connection with the furnaces there has also been built a battery of 120 coke ovens with an output of approximately 2000 tons of coke every 24 hr. The necessary apparatus for taking care of the by-product has also been constructed. It is stated that the company will probably have the most modern layout in the world for a complete two-furnace plant. An iron foundry is at present being built which will be put into operation in the spring of 1920, and which will consume the entire output of the furnaces. It is to be arranged so as to use the hot metal direct from the furnaces.

The Marting Iron & Steel Co., Ironton, Ohio, in the last six months has built and now has in operation a 20 x 100-ft. McKee stove, and has the iron work of the second stove of the same type completed. As soon as this second stove is ready to be put on the furnace the two remaining old stoves will be torn down and in their place a third McKee stove of the same size will be erected. This will thus give a total of four new

stoves for the Marting plant. After the completion of the stove two new boilers of 600 hp. each will be added to the power plant and one large horizontal blowing engine of sufficient capacity to blow the furnace. During 1919 the company relined the Ironton stack and increased the hearth and bosh diameter and added to the power plant and the blowing equipment so that a production of 300 to 350 tons per day is expected. At this plant also the company is now building a Dwight-Lloyd sintering plant to take care of the dust accumulation of all of the furnaces.

The Empire Steel & Iron Co., Catasauqua, Pa., is now engaged in erecting on the site of its No. 12 furnace at Catasauqua, a new blast furnace with a capacity of 450 tons per day. It was designed and is being built by Arthur G. McKee & Co., Cleveland. It will be equipped with skip hoists, McKee revolving top, concrete and steel ore and coke bins. It is hoped that it will be ready for operation by May 1.

The Shenango Furnace Co., Pittsburgh, which owns and operates three blast furnaces at Sharpsville, Pa., and has very large ore interests, completed during 1919 the stripping of its Webb mine near Hibbing, Minn., on the Mesaba range, and expects to have it ready for heavy shipments of ore at the opening of navigation next year. This is one of the larger properties of this company, and has consumed the better part of three years in stripping, and the company believes that it will be in shape to produce about 500,000 tons of ore annually if the future demand should call for it. This company also did considerable work at its blast furnace plant at Sharpsville, Pa., having relined both its No. 1 and No. 3 furnaces, and also made some minor improvements on them while the relining work was being done.

The Struthers Furnace Co. made a number of improvements to its blast furnace at Struthers, Ohio, in 1919. The furnace was relined, a new intake and pump house built and two new Allis-Chalmers generators were installed. The company is now installing a slag-crushing plant.

The Thomas Iron Co. states that at Hokendauqua one blast furnace is being dismantled preparatory to building a modern furnace of 400 tons daily capacity to replace it. There is being added to the Hokendauqua plant a pig-casting machine and an entire new boiler plant with water treatment installation and new steam lines. At Alburtis one furnace has been repaired and will be ready for blast Jan. 1, 1920. The Richard mine at Wharton, N. J., resumed shipments of ore in September after a year's cessation, during which time a new shaft and entire new electrical equipment was installed. During the year the company purchased the Allen & Teabo mines adjoining the Richard, carrying the same ore measures, thus adding largely to its ore reserves. Furnace capacity in operation Jan. 1, 1920, is approximately 15,000 tons per month, of foundry, forge and malleable pig iron. The company expects to blow in the new furnace at Hokendauqua during the first half of this year.

The Thomas Furnace Co., Milwaukee, Wis., is installing a pig-casting machine, skip hoist, coke bin and a gantry crane for handling pig iron and slag storage. The company expects to be in a position to make non-copper low phosphorus pig iron. Because of recent developments in its mines in Michigan it is expected that a better quality of this class of iron will be made than ever before.

The Wickwire Steel Co., Buffalo, N. Y., during 1919 rebuilt its Y furnace from the mantle down, thus increasing its capacity from 400 to 500 tons per day. The new dimensions of this furnace now are 85 ft. x 22 ft. x 17 ft. The old dimensions were 85 ft. x 21 ft. x 14 ft. 6 in. The company now has two furnaces, the other one being 80 ft. x 20 ft. 6 in. x 15 ft.

The Wellston Iron Furnace Co., Wellston, Ohio, in the last 18 months has added two new hot blast stoves to its equipment, one blowing engine and a new pumping outfit and has remodeled and relined its No. 2 furnace, changing the capacity from 150 to 200 tons of pig iron per day. This and other various improvements has changed the company's daily capacity from 200 to 300 tons per day.

The Belfont Iron Works Co., Ironton, Ohio, is making extensive repairs and improvements to its blast furnace by installing new engines, new stoves, skip hoists, ore bins, etc., and expects to have by Feb. 1 a new up-to-date furnace. The company has also put its nail mill entirely on electricity, substituting this for natural gas.

The St. Louis Coke & Chemical Co., Granite City, Ill., in 1919 commenced the erection of a 500-ton blast furnace, the foundations of which are now about 75 per cent completed. The major portion of its output will be used by the Granite City Steel Works owned by the National Enameling & Stamping Co., St. Louis. It is announced that the program of the company calls for five additional blast furnaces, but when they will be built has not yet been determined. The company is also erecting 80 Roberts by-product coke ovens. A portion of the coke from this plant will be used in the blast furnace and the remainder, together with the by-products, sold in the open market.

The Wharton Steel Co., Wharton, N. J., acquired late in 1919 by J. Leonard Replogle and associates, and now known as the Replogle Steel Co., will spend approximately $1,500,000 in new buildings and additions to the plant. Two of the three blast furnaces will be reconstructed, an ore yard equipped with an electric bridge will be provided and stock bins rebuilt.

NEW CANADIAN CONSTRUCTION

New operations in Canada in 1919 and plans for 1920 are the smallest in many years.

Baldwin's Canadian Steel Corporation is the name of the company which is a result of the purchase by Baldwin's, Ltd., England, of the British Forgings Co., Toronto, which contains 10 Heroult electric steel furnaces, built during the war for munitions purposes. The new company will build a $1,000,000 extension to the Toronto plant for accommodating three tin plate mills. The present buildings are also being refitted and equipped. Active manufacturing operations will be started as soon as possible. Raw material is to be brought from Wales, the supply being cheaper there than in the United States.

The Dominion Iron & Steel Co. of Canada in 1919 completed and put in operation at Sydney, N. S., its third by-product coke plant. The new plant consists of 120 Koppers ovens and two batteries of 60 ovens each. Surplus gas produced in this plant is used in the mills as fuel for the soaking pit furnaces, for the heating furnaces and the boilers.

Regaining Normal Conditions

YOUNGSTOWN, OHIO, Dec. 30.—Recovering from the effects of the fuel shortage mills are attaining their old rates in operation, and production this week is closer to normal than at any time since Sept. 22. District companies expect to operate steadily during the first half of 1920. Order books are filled and only a long, steady productive period will relieve the tension under which the steel industry in this section operated during the last quarter of 1919.

Employees, following loss of time due to the strike and to suspensions caused by fuel scarcity, are anxious for continuous work. It is significant that the strike has left no aftermath of bitterness. A majority of the men now admit the error of the move, officials declare, and wish to make up lost time.

Consequently it is expected the output during the first half of the new year will equal the peak war production for a corresponding period. During the layoffs in the past four months, blast furnaces and mills have been repaired and are now in first-class operating condition. Though no new blast furnaces were built in 1919 in the district, productive pig iron capacity was increased by the enlargement of existing stacks in the process of relining and overhauling.

Excellent Year for Machine Tool Trade

Large Part of the Business Came in the Last Half, with Signs All Pointing at Close of 1919 to an Exceptionally Good Business Throughout New Year

WITH machine-tool manufacturing plants in the United States well sold up at the end of 1919, and with many prospects for future business on the horizon, the outlook for the trade in 1920 is more hopeful than it has ever been at New Year, with the possible exception of the war period.

The remarkable expansion of the automotive industries was a principal factor in the demand for machine tools throughout 1919, but manufacturers in other lines entered the market quite freely during the latter part of the year.

Starting out the year with a somewhat discouraging outlook, owing to the tremendous quantities of used and new tools from war plants which were to be put on the market by the Government and private owners, the trade gained steadily from about the first of February, the volume of business during the latter half of the year amounting to very large proportions. At some plants orders have been received at a rate which exceeds anything ever known to the industry aside from the war period.

Year Closed in New York with Large Business

WHILE the early part of the year was characterized by dullness in the machine-tool trade in New York, the latter half of the year, and particularly the last quarter, has been marked by increasingly good business, the culmination coming in November, which was a record-breaking month, almost equaling some of the best months of the war period.

A fair volume of inquiry developed in the early part of the year, but buyers were slow in placing orders because of expectations of lower prices. Makers of machine tools eventually made the expected reductions, but later in the year, with better business, attended by higher costs for iron and steel, they have in practically all instances restored war-time prices, and in some cases the current quotations are higher than were obtained during the war.

There has been some very large buying during the year by individual companies. One of the first to enter the market on a large scale was the E. W. Bliss Co., Brooklyn. Other large buyers included the New Departure Mfg. Co., Bristol, Conn.; the American Locomotive Co., the American Car & Foundry Co., the General Electric Co., the Willys Corporation, the Liberty Starters Co., the Columbia Graphophone Co. and the Standard Oil Co. of New Jersey. All of these companies bought equipment for new plants or plant extensions, and thus indicated in a large way their faith in business prospects for 1920 and years to follow.

There were indications early in the year of a very large export trade, but it was difficult for foreign buyers to make adequate credit arrangements, and much business in France and Belgium that was expected to come to this country went to Germany because of the advantage which buyers in those countries possessed by reason of the low value of the German mark and the possibility of financing purchases from Germany through the indemnities which that country is forced to pay under the peace treaty.

Later in the year, when European buyers were ready to place orders for highly favored American machines, the exchange situation made such buying so expensive that only a relatively small proportion of such expected business materialized. Japan, China and South America have been fairly good buyers of American tools, not being adversely affected by depreciated exchange values.

Throughout the first half of the year the great quantities of used war tools in the hands of the Government and private owners hung like a gray cloud over the machine-tool market. Large quantities of tools from war plants found their way into the market and were freely purchased even at times when sales of new tools were at a very low point. The Government was slow in inventorying and offering for sale its large accumulation, and meanwhile business in new tools had been gradually improving until manufacturers of tools no longer feared that their trade would be seriously injured by offerings of the Government surplus. The avowed policy of the Government to obtain the highest market prices for the surplus was a steadying factor. Late in the year the sale of $25,000,000 worth of the Government surplus was welcome news, as it was recognized as a factor in the rehabilitation of French industries as well as taking out of the markets a considerable part of the Government holdings.

An amazing feature of the situation at the close of the year was an actual scarcity of good, used tools of standard types, particularly heavy machines such as planers and boring mills. There was also, and continues to be, a demand for used gear shapers, grinders, precision lathes and other small and medium-sized tools.

The automotive industries have furnished a goodly share of Eastern machine-tool business in the past year, but manufacturers in other metal-working lines have also bought freely in the last quarter, with indications that this buying is the forerunner of unusually prosperous conditions for the trade in 1920. Certainly the machine-tool trade has never entered a new year, except for the war period, with more business in sight. The signs all point to a banner year in 1920.

Satisfactory Year in the Chicago District

CHICAGO machine tool dealers can look back with satisfaction on the business done in 1919, notwithstanding the fact that the early months of the year were anything but promising. According to estimates by the trade, the total bookings of the twelve-month period will aggregate $15,000,000, but sales expense mounted considerably higher than during the war months. The cost of selling rose because individual orders were as a rule small in marked contrast with the large contracts which were the rule before the signing of the armistice. The automotive industry proved the one prominent exception of the year, buying generously in conformity with the rapid expansion of its manufacturing facilities. Estimates

by the local trade of the proportion of its gross business attributable to purchases by automobile, tractor and affiliated manufacturers, range from 35 to 50 per cent. In the adjacent Detroit district, the average was undoubtedly much higher.

For the first five months of the year, the Chicago tool market was dull. In January the Chicago & Alton Railroad bought a fair-sized list at concessions below the ruling prices. Shortly afterward the Chicago, Burlington & Quincy Railroad and the Bucyrus Co., South Milwaukee, Wis., issued extended lists, but action on these was subsequently indefinitely deferred on account of expected declines in prices. In February and March, a few tool builders reduced prices, but it was not until the middle of April that general recessions in quotations developed. At that time engine lathes were marked down from 15 to 20 per cent, planers about 20 per cent, milling machines 10 to 20 per cent, radial drills 10 per cent, and other tools in like proportion.

By the end of May, the trade was becoming optimistic, not only because the aggregate business of the month was considerably above that of April but because users were beginning to break away from their hand-to-mouth policy of buying. May proved the best month since the armistice and June sales proved twice as large as those in May. On July 1, one manufacturer of shapers raised prices 5 per cent, while a line of multiple spindle drills advanced 10 per cent. At this time deliveries commenced to become a problem, this constituting a reflection of the upturn in business although, in some measure, it was due to labor difficulties in the tool manufacturing plants. On Aug. 1, western manufacturers of engine lathes raised prices from 10 to 16 2/3 per cent, thereby furnishing further evidence of the expansion in demand. According to estimate of a prominent local dealer, business closed in August was double that of July, which was about 80 per cent of a normal war month. In September, a further price advance occurred, some makes of planers and milling machines advancing from 10 to 15 per cent while one manufacturer of punch presses marked up his quotations 10 per cent.

Early in the fall, deliveries had become the one serious limitation on business. It is said that the delays in delivery from manufacturers constituted the principal reason for the purchase of approximately $50,000 worth of Government tools for the Moline Plow Co.'s tractor plant. Despite this difficulty, business continued to grow in volume during the last quarter of the year, particularly large purchases being made by the automotive manufacturers, prominent among which were the Samson Tractor Works, Janesville, Wis., the Nash Motors Co., Kenosha and Milwaukee, Wis., and the Continental Motors Co., Muskegon, Mich.

Dealers are of the opinion that the gross business of 1919 will compare favorably with that done in 1918, probably within 75 to 90 per cent of the total sales of the last war year. The cost of selling, however, was considerably higher than during the war months because individual orders were usually small, in marked contrast with the large contracts which were the rule before the signing of the armistice. The automotive industry proved the one prominent exception of the year, buying generously in conformity with the expansion of its manufacturing facilities. Several motor and tractor plants purchased several hundred thousand dollars worth of machinery at a time, while others bought repeatedly on a somewhat smaller scale. It is estimated by the trade that purchases by the automotive industry in this district during the year aggregated over $3,000,000. In the adjacent Detroit district the total was probably considerably higher. Although the automobile, tractor and truck manufacturers were conspicuous because of their large individual purchases, it is believed that the largest buyer of equipment was the sheet metal industry, which bought approximately $5,000,000 worth of tools in the Chicago territory.

To a certain extent, of course, there is an overlap in the total purchases by these two industries, as undoubtedly some of the sheet metal stamping and cutting equipment bought was installed in shops of automobile or affiliated manufacturers.

In the middle of October there were again price advances in planers, milling machines and radial drills, and in November a few other tool builders followed suit. As the year ends, the general price level is close to that which prevailed during the war period and further raises are expected about the first of 1920. Deliveries are worse than at any time since the cessation of the war, in the case of some tools as far ahead as five to seven months. The delivery problem is attributable both to the large bookings of the tool builders and labor difficulties. Some manufacturers in this district were forced to shut down on account of strikes in the spring and late this fall were forced to curtail operations during the coal strike, but the principal limitation on production has been the unsatisfactory morale of the employees. A machine tool manufacturer in this territory estimates that the average output per man has decreased from 50 to 75 per cent. One machine which was formerly produced in 150 hours, now consumes a total of 400 hours of the workmen's time. Unless this situation is remedied, it is doubtful whether prices during the coming months can take any turn except upward.

Cleveland Trade Has Been Excellent

THE two extremes marked the beginning and the end of the year in the machine-tool market in the Cleveland territory during 1919. The year opened with gloomy forebodings in the trade and uncertainty about the future, but ended with an active market that has continued for the greater part of the year and a bright outlook for the future that is reflected in a very optimistic feeling in the trade.

Probably close to 90 per cent of the machine tool business in the Central West during the year came from the automotive industry. The motor car builders in the Northern Ohio and Michigan territories and Indiana were large buyers of equipment and the manufacturers of automobile parts also purchased a great deal of machinery. Akron rubber companies also added a large amount of new equipment during the year for the manufacture of tire molds and there was an active demand for machine tools for the manufacture of rubber-making machinery.

During the first two or three months of the year the market was rather quiet, as it took the automobile companies some time to get their plants, which had been almost wholly on war-time work, readjusted to a resumption of the manufacture of motor cars and to line up their machinery requirements. Practically all the automobile builders added a great deal of machinery equipment during the year, but the purchases of the General Motors Corporation were particularly prominent because of their magnitude. This corporation is credited with buying $3,000,000 worth of equipment for one new plant, its engine and transmission plant at Walkerville, Ont., and it bought a large amount of machinery for its various plants in the Michigan territory and at Toledo. One order placed by this interest with an Ohio machine tool builder was for approximately $1,000,000 worth of machinery.

With the scarcity of labor and high wages that prevailed during the year, the policy of automobile manufacturers has been to install new labor-saving machinery to enable them to get higher production and to reduce costs. The tendency of the motor car and automobile parts manufacturers to use special and single purpose machines has probably been more marked during the year than ever before. This is particularly true of machines used for turning work, special and single purpose machinery replacing standard lathes and turret lathes for various turning operations. In other words, this industry is developing its own particular line of machines that are not applicable to other industries. A conspicuous development in this direction made early

in the history of the automobile industry was the use of special types of multiple spindle drilling machinery for drilling, tapping, reaming and other operations.

The demand for labor-saving machinery stimulated sales of automatic screw machinery, which were heavy during the year, and the orders taken by one Cleveland manufacturer of this machinery aggregated as much up to Sept. 15 as during the entire previous year. From 75 to 80 per cent of these machines went directly or indirectly to the automobile industry, this percentage being somewhat above normal.

The machinery market did not really become active until about May 1. Before that time the automobile manufacturers were getting their plans ready for the season and switching their plants over for war work. However, some buying began in a small way in January and in that month the first round lot inquiry developed, coming from the General Motors Corporation for equipment for its Chevrolet plant in Toledo. Since then this interest has been in the market almost every week for additional equipment for one or more of its various plants and during the year practically all the other automobile companies purchased a very large amount of additional equipment.

With war-time prices prevailing at the beginning of the year buyers began in January to demand price reductions. During the next two months there was quite a general readjustment of prices to lower levels, but during the last month or two of the year many machine tool builders, with the increased cost of raw material, particularly higher prices for pig iron and castings, found it necessary to again advance prices.

The view is generally expressed by the machine tool builders that a new year has never started with a better outlook in the machinery market than there is at present for a heavy volume of business in 1920. They base this expectation to a large extent on their belief in a continuance of the growth of the automotive industry. The end of the expansion of this industry is not yet in sight, but it is pointed out that should the automobile builders call a halt to further plant extensions, the demand from this source for machines for replacements is bound to be heavy.

With the rapid expansion of machine tool plants during the war, few companies found it necessary to make large extensions to their plants during the year, but two important additions are now being made to the machine tool industry in Cleveland—the new plants being erected by the Foote-Burt Co. and the Colburn Machine Tool Co., both for building drilling machinery. One notable extension was made to the machine tool building capacity of this territory during the year, that being a large extension to the plant of the Defiance Machine Works, Defiance, Ohio, for building special drilling and other machinery used in the automotive field.

Cincinnati Manufacturers Well Sold Up

AT the start of the year 1919 great uncertainty in the machine tool trade was evidenced at Cincinnati. This industry, which had been working at top speed during the war period, was naturally one of the first to be affected by the signing of the armistice, and manufacturers who had made heavy expenditures for new buildings and equipment, were anxiously seeking new markets for the disposal of their output. The export trade seemed to offer the best opportunity, particularly South American countries and Japan, and some very good orders were obtained. The inquiry from European countries was very heavy, but high freight rates and shortage of tonnage retarded trading in the first half of the year, while money exchange conditions during the last half practically brought business to a standstill with England, France and Belgium. Trade with Spain, South America, Japan, Australia and South Africa is still fairly good, however, particularly in the smaller tools.

Early in the year the automotive companies entered the market for machine tools, and business has been very steady, particularly for boring mills. After the first few months of the readjustment period, the domestic demand began to peak up, and while the automobile manufacturers were the heaviest buyers, dealers in every section of the country commenced to stock up, with the result that manufacturers were enabled to keep their plants running practically up to their capacity. A pattern makers striks during the month of August interfered somewhat with operations by curtailing the production of castings.

By Sept. 1, domestic demand for all types of machine tools had become very heavy and all plants had sufficient orders on their books to keep them busy well ahead. Export orders from Scandinavian countries and Spain were also heavy and this condition has existed up to the present, and orders are still coming in at a very steady rate. At the close of the year manufacturers are very well pleased with the volume of business during the past twelve months and are very optimistic as to the future. Most of the dealers are sold out for first quarter shipments, with some lines completely booked till July.

Labor conditions in the Cincinnati district during the year were satisfactory. During the first half there was an over supply of unskilled labor, but the skilled men were pretty steadily employed. No serious labor troubles were experienced, although during the month of August the machinists' union presented demands for higher wages and shorter hours and strikes were called in several plants, but most of these were settled by the men returning to work. Cincinnati manufacturers strictly adhere to the open shop policy and find it works very satisfactorily. At the close of the year a number of minor strikes are in effect, but the places of the men out have been filled with the result that operations are not seriously affected. There is a scarcity of skilled workmen.

Pittsburgh Machine-Tool Trade in 1919

MANUFACTURERS and dealers in the heavier and lighter machine tools in the Pittsburgh district report the volume of business in 1919 as being fairly satisfactory in the first half of the year, and very much larger in the second half.

The largest increase in the use of machine tools during 1919 came from the manufacturers of tools for oil well drilling purposes. These concerns were large buyers of steam hammers, and to some extent of lathes and other machine equipment. This increase in demand for machine tools from the oil well supply trade promises to last, and to increase largely this year. Development in new oil fields in 1919 were on the greatest scale ever known, and inquiry for tools and all other equipment used in drilling wells promises to be very heavy over the next several years.

The railroads were only fair buyers of machine tools in 1919, placing orders only for such equipment as they absolutely needed. A possible exception to this was the Pennsylvania Lines West, which built shops during the year at Stark and Thomas, Ohio, and Logansport, Ind. In the equipment of these shops, large quantities of machine tools were bought, and this road was the largest single buyer of any of the railroads in this district last year. The outlook for the buying of machine tools by the railroads in 1920 is not very clear.

Purchases of machine tools by iron and steel manufacturers in 1919 were only fair. Makers of iron and steel believed early in the year they would have to sell their products at lower prices, the outlook was uncertain, and they limited their buying of machine tools largely to actual needs. The amount of new construc-

tion in iron and steel plants, also in blast furnaces in 1919, was much less than in any preceding year for a long time. This was largely for the reason that labor was high and scarce, material was high and there was much uncertainty as to the future of the steel trade. The outlook for this year, however, is that buying of machine tools by the iron and steel manufacturers will be much larger than in 1919. Plans are under way for large extensions to existing plants, and some new steel works construction has already been started. Notable among these is the new sheet mill plant of Follansbee Brothers Co. at Toronto, Ohio, work on which is going forward as rapidly as possible. This concern has already bought considerable quantities of machine tools, and will also be a heavy buyer of cranes and other equipment. It is also stated that the plans of the Steel Corporation for extensions to existing plants this year are quite large, and that it will build more new extensions this year than for some time.

In heavy machinery equipment for rolling mills and steel works, there are five or six large concerns in the Pittsburgh district, and all these report a fairly heavy volume of business in the first half of the year, and a much larger business in the last half. These concerns also state that they are now filled up with orders for some months ahead, and regard the outlook for future business as very bright. The expectation is that these concerns will enjoy a large foreign trade in iron and steel works equipment this year, and for some years to come.

The United Engineering & Foundry Co., Mesta Machine Co., A. Garrison Foundry Co. and other builders of iron and steel works equipment, have already taken considerable foreign business, and are said to be figuring on much more. The United Engineering & Foundry Co. took a very large contract late in 1919 for steel works equipment for France that will take some months to complete.

A Satisfactory Year In New England

ALTHOUGH having its drawbacks, 1919 proved far more satisfactory to the New England machine-tool interests than was anticipated a year ago. The year opened in a dubious manner, January, February and March sales by the average manufacturer and manufacturing representative being subnormal as compared with those recorded for the corresponding period prior to the United States entering the World War.

February proved an especially poor month with most everybody, in a majority of instances being the poorest month of the year. This business reaction coming after the activity accompanying our war-time machinery needs, together with a general fear among manufacturers that Government holdings of machines finished or partly so would force lower prices for new products notwithstanding the constantly increasing cost and unrest of labor, as well as some differences of opinion with Government officials as to the proper basis of settlement for machines in process of manufacture on Government contract, and cancellation of Government contracts, all naturally made for more or less pessimism.

In April, however, there was an improvement in business sufficient to improve sentiment in general. In May, some of the manufacturers reported another falling off in sales to about the first quarter average, while others reported further increases in bookings. That month, as a whole, averaged well with April. In June the pendulum showed a definite swing toward prosperity and activity, and in July, August, September, October and November, there was a steady growth in business that reached its apex during the middle of November.

Those five months saw an increase in most manufacturers' bookings that average 20 to 25 per cent better than was the case during the corresponding period of 1917. In many instances the average ran higher, so that New England's machine-tool showing was generally considered highly satisfactory in volume. The turn for the better was due to a general expansion in our industrial activity based on a resumption of confidence.

The increase in the demand for candy machinery was especially noticeable, and was generally credited to the direct result of prohibition. There was a marked increase in the demand for textile machinery, the result of a world shortage of cotton and woolen fabrics; in the demand for household, dairy and farm machines, especially washing machines and tractors, the result of a wide-felt shortage of labor; in the demand for automobile working equipment, largely the result of a wave of extravagance that swept over practically the entire country.

An increase in the demand for paper making machines, and, in fact, for machines used in almost every branch of industry, was the result of a shortage of things in general, and partly the result of large surplus cash holdings obtained from war contracts by corporations, which provided means for plant expansion. The only important branch of industry that showed no visible expansion was the railroad.

In December the demand for machine-tools fell off to some extent, although the close of the year found a good business doing in one and two machine lots. As to deliveries—in June they were normal. Since then they have, generally speaking, become extended on most manufactured machines. Instances can be found, however, where prompt deliveries on special equipment could be made Dec. 31. But on the large number, the tool makers are well sold ahead, some of them four, five and six months, and others from nine to virtually twelve months.

The increasing demand for equipment following the steel strike and in the face of a coal strike, brought about an upward revision in machine-tool values, both for new and second-hand. It is possible, however, that even with higher prices for their products all makers in 1919 were not as prosperous as anticipated, due to the pronounced increase in their overhead and operating expenses.

The year closed with the machine-tool manufacturers in a far better position than was the case on Dec. 31, 1918. Generally speaking, they have a substantial backlog of business on their books. In addition there is every indication that there will be some substantial new equipment buying during the early months of 1920. In addition again, the eyes of many a tool maker are turned toward foreign countries notwithstanding the condition of the foreign exchange market.

The New England Small Tool Market

The past year was one beset with many vital problems for the New England manufacturer of small tools. These problems were met and largely overcome, but at the expense of net profit.

Following the signing of the armistice in 1918, there was a period when the small tool business dropped to comparatively small proportions. That condition of business was largely due to a general expectation of lower values for raw materials, labor and finished products. Comparative inactivity extended over the greater part of six months and in that time many of the small tool makers did not earn the dividend on their stock.

There was, however, sufficient business transacted with foreign countries by certain tool manufacturers to eventually lend encouragement to the industry as a whole. This business was supplemented by demands from the rapidly expanding automobile industry, especially in the Middle West. Sufficient impetus was given the small tool market to convince the maker and consumer alike that lower prices were unlikely.

But production in quantity sufficient to meet expected requirements was greatly retarded by unrest and lack of labor which made for inefficiency. Production by man and machine decreased, in some instances to an alarming degree, which necessitated increases in working forces.

The tool producer hardly had begun to overcome the

labor problem than the steel strike developed with its attendant uncertainty as regards our general industrial life. Once more the tool maker's output was threatened, while at the same time demands made upon him by consumers grew by leaps and bounds. The nightmare of the steel strike eventually evaporated, but the small tool industry was soon upset by the coal strike and the threatened curtailment of operations through fuel regulations by the Administration.

Fortunately, however, fuel regulations were not enforced in sufficient length of time to become a vital factor so far as operation of individual small tool plants is concerned. But unfortunately the inability of the steel mills to secure sufficient fuel to turn out raw material for the tool maker in desired quantities resulted from the coal strike. The close of 1919 found the small tool maker struggling with the problem of raw material.

These and other problems less important, as can be seen, constantly made for restricted small tool output. In the meantime the rank and file of tool makers have accumulated enough orders to insure capacity operation of plants for periods ranging from six weeks to six months, and in some special instances for a longer time.

Large Tool Business at Detroit

STATEMENTS from a number of Detroit machine tool and supply dealers lead to the conclusion that the volume of business for 1919 was about 75 per cent of that for 1918, which was the peak year of the war business. One hundred per cent business is predicted for the coming year.

At the beginning of the year things looked blue, because the automotive industry, which buys about 80 per cent of the machine tools purchased in the Detroit territory, was engaged in closing up its war contracts with the Government and was meeting many discouraging delays in the process. By the beginning of May business had picked up wonderfully and was booming from day to day until late in the summer, when there was a decided slump, owing to the fact that strikes were making production precarious, and also because deliveries from machine tool manufacturers were exceedingly slow. Then in the fall came the steel and coal strikes, which made manufacturers slow in ordering tools.

During the last two months of 1919, the machine tool business picked up amazingly. Prospects for the future in the machine tool trade in the Detroit territory were never brighter than they are now, according to every dealer in the city who expressed an opinion. That labor agitation is all that is holding the trade back is the opinion of the Chicago Pneumatic Tool Co., Detroit branch, Charles A. Strelinger Co., W. J. Baird Machinery Co., Duplex Machine & Tool Co., Strong, Carlisle & Hammond, Gorham Tool Co., J. R. Stone Tool & Supply Co., Detroit Tool Co., Pratt & Whitney Co. and others. All the companies named are expecting large increases in business as soon as the steel strike trouble is settled.

The Week's Market

New York

NEW YORK, Dec. 30.

The year closes with good business in practically all types of metal-working tools, and on some lines deliveries extend well into the middle or latter half of 1920. A good many buyers whose needs have been before the trade for weeks have closed for their requirements to anticipate any advance in prices on Jan. 1.

One of the largest buyers is the American Car & Foundry Co., which has bought plateworking machines, two 1000-ton forging presses and other equipment. Some large machine tools are still to be bought, but orders are expected this week.

The Wright Aeronautical Corporation, which issued a list of about 200 tools recently, has purchased from the Merchants National Bank a site of five and a half acres at Freylinghusen and Meeker avenues, Newark, N. J., for a manufacturing plant. A building with approximately 100,000 sq. ft. of floor space will be erected. Orders have not been placed for machine-tool requirements, and it is reported in the trade that the company is negotiating with the Government for some of the tools in the plant operated during the war by the Wright-Martin Aircraft Corporation at Long Island City.

The Poole Engineering & Machine Co., Baltimore, has begun the placing of orders on a list of equipment required for the manufacture of electric washing machines, this being a new line for that company. Orders are also being placed by the Neptune Meter Co., New York, and C. H. Johannson, Inc., Poughkeepsie, N. Y. The General Electric Co. continues to buy and has issued new inquiries, some for its Pittsfield, Mass., plant.

Some crane manufacturers are expecting an increase of 5 per cent in prices early in 1920. Builders of locomotive cranes anticipate large orders some time after March 1, if the railroads, as is now expected, are at that time returned to the owners. Business continues slow, although most of the large inquiries that have been in the market for some time have livened up and several will probably have developed into orders by the time this issue reaches the readers.

The American Car & Foundry Co., which has been in the market for some time, has purchased the material, including cranes, for the Buffalo plant, but at this writing the Chicago section of the inquiry is still pending. The Phelps Dodge Co. engineer has made recommendation on the crane purchase of that company and the Willys Corporation is also on the point of placing its order. The recent inquiry of the Westinghouse Electric & Mfg. Co. for cranes at the Essington plant is also on the point of being placed. Bids on the four 3-ton, semi-portal revolving jib cranes for the Barge Canal, at Greenpoint, Brooklyn and West Fifty-third Street, New York, have been opened but no award made. The Shepard Electric Crane & Hoist Co. was the low bidder out of eight, with the Wellman-Seaver-Morgan Co. second and Heyl & Patterson third. The Vermont Marble Co., Proctor, Vt., is in the market for a 2-ton, 60-ft. span, floor control, bridge crane with 120-ft. runway. The B. F. Goodrich Co., Akron, Ohio, is inquiring for three 15-ton electric traveling cranes. The Standard Oil Co. has an inquiry out for a 2-ton hand-power crane for Charleston, W. Va., and another for a 5-ton, hand-power crane to be shipped to Rumania. The Union Shipbuilding Co., which recently issued an inquiry for a number of cranes, has purchased nine from the Toledo Bridge & Crane Co.

The E. Behringer Sheet Metal Works, Inc., 315 East Ninety-seventh Street, New York, will soon call for bids for the erection of a one-story building, 125 x 150 ft., at Flushing and Wyckoff avenues, Brooklyn, to cost about $50,000. Louis Allmendinger, 20 Palmetto Street, Brooklyn, is the architect.

The Willys-Morrow Co., Elmira, N. Y., manufacturer of automobile parts, has arranged for the erection of an addition to cost about $150,000.

The Goulds Mfg. Co., New York, manufacturer of pumping machinery, with plant at Seneca Falls, N. Y., has arranged for the purchase of the seven-story building, 25 x 152 ft., at 19 Park Place, extending through to 16 Murray Street.

The American Machine & Foundry Co., Second Avenue and Fifty-sixth Street, Brooklyn, has arranged for the erection of a six-story addition, 127 x 190 ft.

The Hauck Mfg. Co., 113 Eleventh street, Brooklyn, manufacturer of oil burners, has had plans prepared for the erection of a new two-story building on Tenth street, near Second avenue, to cost about $20,000.

The Utica Cutlery Co., 820 Hickory Street, Utica, N. Y., has awarded a contract to Griffiths & Pierce, 618 Charlotte Street, for the erection of a three-story addition, 55 x 223 ft.

The Consul General of Chile, 165 Broadway, New York, will receive bids up to March 15, 1920, for opening at the

office of the Commissioner of Ports, Santiago, Chile, for machinery and equipment for a new electric light and power plant at the harbor works, Valparaiso.

The Lionel Mfg. Co., 605 South Twenty-first Street, Irvington, Newark, N. J., manufacturer of electric toys, batteries, etc., will build a two-story addition, 33 x 34 ft.

The Hamblin Tool Mfg. Co., Newark, N. J., has leased the second and third floors of the building at 42 Mechanic Street, for the establishment of a new plant. Walter Middleton is president.

The L. E. Waterman Co., 191 Broadway, New York, has filed plans for the erection of its new fountain pen manufacturing plant at 247-69 Peddie Street, Newark, N. J., comprising an eight-story, reinforced-concrete building, 60 x 240 ft. with two extensions, each 80 x 240 ft. The new plant with equipment will cost about $1,500,000.

The Independent Lamp & Wire Works, Inc., 538 Gregory Avenue, Weehawken, N. J., has arranged for the erection of an addition to its plant.

New England

BOSTON, Dec. 29.

Active buying of single machine tools continued during the closing days of the year and orders received dated Dec. 24 were quite unusual, according to local representatives. No large contracts, however, have been closed. Prices are strong and one line of vertical boring mills and a line of upright drills have been advanced again, effective Jan. 1. Deliveries are more extended.

The Lever Brothers Co., Cambridge, Mass., soap manufacturer, has issued a list calling for eight second-hand tools. The Revere Sugar Co., Boston, is in the market for a small amount of equipment. The Greenfield Tap & Die Co., Greenfield, Mass., has not yet covered its requirements on lathes, drilling machines, etc. The Converse Rubber Shoe Co., Malden, Mass., and the Bangor Electric Railway & Electric Co., Bangor, Me., have bought machine-shop equipment. The Universal Boring Machine Co. has sold several lathes since last reports. The Stevens-Duryea Co. has covered its requirements on motors, but will buy considerable machine-tool equipment in the coming months. The Vernon Machine Co., Worcester, Mass., is planning to produce motor-driven 12-in. and 14-in. lathes, instead of belt driven, as at present. It is doing a large export business, especially to France. The Billings & Spencer Mfg. Co., Hartford, Conn., is planning to spend $250,000 for expansion and equipment.

The Westfield Plate Co., Thompsonville, Conn., has consolidated with the International Casket Co., Meriden, Conn., and the Meriden equipment will be moved to Thompsonville. Both concerns manufacture casket hardware. Arthur Manning, South Manchester, Conn., is president of the new company, and Edwin S. Klein, secretary-treasurer and general manager.

The Petroleum Heat & Power Co., a $2,000,000 corporation backed by Boston and New York capital, has bought a large tract of land on the harbor at Stamford, Conn., on which a plant, 160 x 200 ft., will be erected. The company is a reorganization of the Fess Rotary Oil Burner Co., Boston.

Plans are being drawn for a one-story machine shop addition, 50 x 60 ft., to the Moore Drop Forging Co., Springfield, Mass.

The Eco Mfg. Co., Wormwood Street, Boston, automobile accessories and parts, will build a two-story factory, 110 x 150 ft., on the Charles River Parkway, Cambridge, Mass.

The General Electric Co., Lynn, contemplates the erection of a one-story, 89 x 206 ft., plant at Taunton, Weir Village, Mass., in the near future.

Plans are in preparation for a four-story extension, 80 x 200 ft., at the plant of the Seth Thomas Clock Co., Thomaston, Conn.

The Vitrified Wheel Co., Westfield, Mass., will erect a two-story factory, 40 x 80 ft., before spring.

Work will shortly start on a five-story, 60 x 150 ft. factory for the Bassick Co., on Austin Street, Bridgeport, Conn., manufacturer of casters.

Congress has appropriated $500,000 for shops and facilities at the Commonwealth Drydock, Boston, recently purchased and opened by the Navy Department.

The Turner Construction Co., of New York and Boston, has secured contract from the L. E. Waterman Co., for the erection of a reinforced concrete factory at Seymour, Conn. It will be six stories with 4,000 sq. ft. per floor and will cost about $155,000. Work will begin at once.

Philadelphia

PHILADELPHIA, Dec. 29.

The Wicaco Screw & Machine Works, Inc., Seventh and Wood streets, Philadelphia, is having plans revised for its new two-story building, 82 x 321 ft., at Louden Street and Stenton Avenue, to cost about $100,000, and will soon ask for bids.

A new one-story factory, 165 x 295 ft., to cost about $145,000, including equipment, will be erected by the Philadelphia Paper Manufacturing Co., River Road, Philadelphia, manufacturer of box board specialties.

The Bigelow-Willey Motor Co., 304 North Broad Street, Philadelphia, is having plans prepared for a new machine works and automobile service building at Broad and Vine streets, to cost about $100,000.

The Enterprise Manufacturing Co., Third and Dauphin streets, Philadelphia, manufacturer of hardware specialties, has completed plans for a three-story, reinforced-concrete and brick addition, 115 x 164 ft.

The Wirt Co., Armat and Lena streets, Philadelphia, manufacturer of electrical products, has filed plans for the erection of an addition, with improvements in its present plant, to cost about $18,000. Charles Wirt is president.

The American Bridge Co., Trenton, N. J., is planning for additions and improvements at its local plant to cost about $1,500,000. The work will include a new main shop building, 200 x 600 ft., and a new templet shop 60 x 225 ft.; the present forge shop will be relocated in another structure, and an extensive addition constructed. Two new 200-ft. crane runways will be installed and new electric-operated cranes will be provided. A hospital building, 40 x 40 ft., for employees, will also be erected. The work will be inaugurated at an early date and is expected to be completed next fall.

The Playford Mfg. Co., Elgin, Ill., manufacturer of concrete-steel products, is planning for the establishment of a branch plant at Trenton, N. J. It is proposed to lease an existing building for the works.

The Crescent Insulated Wire & Cable Co., Olden and Taylor streets, Trenton, N. J., has acquired property in the vicinity of its plant on Webster Street for extensions.

The American Steel & Wire Co., Hamilton Avenue, Trenton, N. J., is taking bids for a one-story addition, 60 x 100 ft., at Hamilton Avenue and Canal Street, to cost about $20,000.

The Ajax Rubber Co., Breunig Avenue, Trenton, N. J., manufacturer of automobile tires, has filed plans for a three-story, brick addition, to cost $39,000.

The W. C. Runkles Machinery Co., Prospect Street and Pennington Avenue, Trenton, N. J., is having plans prepared for an addition, 74 x 144 ft.

The East Penn Foundry Co., Macungie, Pa., will soon break ground for the construction of an addition to its foundry. Plans have been completed.

The Danville Iron & Steel Co., Danville, Pa., will build a one-story machine shop, 100 x 100 ft., to cost about $40,000. E. W. Peters is secretary.

Baltimore

BALTIMORE, Dec. 29.

The J. C. Eichman Mfg. Co., Bush and Wicomico Streets, Baltimore, manufacturer of plumbers' supplies, etc., will build two additions, 20 x 47 ft., and 21 x 36 ft., respectively.

The Poole Engineering & Machine Co., Woodberry, Baltimore, will install 200-hp. in motors.

The American Sugar Refining Co., 117 Wall Street, New York, will build a plant in Baltimore representing an outlay of about $8,000,000.

Potter & Shackelford, Sullivan Building, Greenville, N. C., is interested in quotations on hoisting engines.

The W. J. Westbrook Elevator Co., Greensboro, N. C., will build a foundry and install a furnace and machinery for the manufacture of machine castings. Prices on equipment are wanted.

The Champion Motors Corporation will build a plant for the manufacture of automobiles at Canton, Baltimore, construction to start about March 1. The new corporation will take over the established Champion car business of the Direct Motor Co., Philadelphia, and move the plant to Baltimore. Henry Crowther is president and J. Kemp Bartlett, U. S. F. & G. Building, Baltimore, is one of the directors.

The Automotive Tractor Co., Frederick, Md., will take bids early in 1920 for its new one-story plant, 50 x 200 ft., comprising machine shop and foundry, and estimated to cost $50,000.

Lyon Conklin & Co., 13 Balderston Street, Baltimore, manufacturer of sheet metal products, a Delaware corporation, has increased its capital from $50,000 to $500,000.

The Wilmington Automobile Co., Tenth Street, Wilmington, Del., is considering the erection of a four-story machine and service building to replace its present structure, at an estimated cost in excess of $100,000, including equipment.

The Reliance Electric Co., 771 Granby Street, Norfolk, Va., is completing plans for the erection of a two-story electric repair and service works, 40 x 104 ft., at Jamestown Boulevard and Monteo Street, to cost about $70,000.

The Electrical Equipment Co., Miami, Fla., has been incorporated with a capital of $100,000 by William W. Luce, F. W. Borton and Arnold H. Kent, to manufacture electrical specialties.

The Standard Sanitary Mfg. Co., 628 Shipp Street, Louisville, Ky., is planning for the erection of an addition to its foundry to cost $20,000.

Gilbert Cowan & Co., Louisville, Ky., are planning for the erection of a two-story machine works and automobile service building, 50 x 150 ft., to cost about $50,000.

The Virginia Railway & Power Co., Richmond, Va., is planning for extensions and improvements in its electric power plants and system to cost about $1,100,000. T. S. Wheelwright is president.

Cincinnati

CINCINNATI, Dec. 29.

The machine tool business continues brisk. While in previous years the holiday season has generally been the most quiet of the year, this has proved an exception, and orders at coming in at a steady rate with the automotive companies still the chief buyers. The Olds, Packard and Chevrolet motor companies have lists out for specialized machinery and are expected to place fairly large orders. Deliveries are still running far behind. Sales of second-hand machinery have also been very good, the fact that immediate delivery can be made being a great inducement, with the result that stocks in the local warehouse are getting somewhat depleted. No price changes are announced.

One southern Ohio manufacturer the past week received an order for a half dozen machine tools for export to Italy, and a local firm also secured a small order from the same source. The Ordnance Salvage Board shipped 250 standard machine tools to Belgium the past week and also disposed of about $30,000 worth of machinery to a large manufacturer. The latter sale consisted of new tools which had not been delivered when the armistice was signed, and brought 95 per cent of the original purchase price.

The Carrell Engineering Co., Xenia Ave., Dayton, Ohio, manufacturer of gages, jigs, dies, etc., has increased its capital stock from $100,000 to $300,000, and has made tentative plans to increase its output.

The Recording Devices Co., Dayton, has increased its capital stock to $2,500,000. It manufactures time clocks and has recently entered the automobile accessory field, making wind shields, door latches, piston pins, valve tappets, etc. E. E. Burkhardt is president.

A permit has been issued to the Domestic Engineering Co., Dayton, for the construction of a six-story steel and concrete building, 80 x 300 ft., to cost $400,000. Schenck & Williams are the architects and contractors.

A permit for the erection of an addition to the enameling building, to cost $19,000, has been issued to the Estate Stove Works, Hamilton, Ohio.

The Columbus Heating & Ventilating Co., Columbus, Ohio, is contemplating the erection of an addition, 100 x 120 ft.

Detroit

DETROIT, Dec. 29.

Sales of machine tools and supplies continue brisk and dealers look forward to a steadily increasing trade.

The J. C. Green Foundry Co. has purchased a seven-acre site at Vassar, Mich., the first foundry unit, 60 x 160 ft., to be constructed at once.

The F. H. Darrow Steel Boat Co., Albion, Mich., is making plans to increase its output ten times.

The Republic Motor Truck Co., Alma, Mich., plans to spend $200,000 in the next two months for additional buildings and equipment.

Construction of the machine shop and power plant of the Petoskey Portland Cement Co., Petoskey, Mich., will start Jan. 1, and is expected to be completed by September. A. B. Klise is president.

The business of the Smalley General Co., machinery manufacturer of Bay City, Mich., has grown so rapidly that plans are being made for an immediate increase in capacity. Details will be announced later.

Chicago

CHICAGO, Dec. 29.

There has been no let-up in the number of small orders which have been pouring into this market almost without interruption during the last half of the year. It is possible that the rumors of early price advances may account for the placing of some business which, ordinarily, would have been postponed until after the holidays. It is also likely that the growing delay in deliveries constitutes a potent reason for prompt purchases of machine-tool requirements. The demand for ball-bearing sensitive drills, milling machines and punch presses is very heavy, but current inquiries include such a variety of machines that it is difficult to particularize in describing the character of the market. Large individual transactions are the exception, the biggest of recent date being a $50,000 purchase of equipment by the Chicago, Burlington & Quincy Railroad and orders by the Buda Co., Harvey, Ill., which aggregate about $20,000. The Nash Motors Co., which has been a heavy buyer of tools this year, is planning further expansion which will mean the placing of additional orders. This company, which is now constructing a plant in Milwaukee, with about 120,000 sq. ft. of floor space, contemplates adding other buildings of much larger proportions.

The Excel Motor Truck Co. has awarded a contract for the erection of a one-story plant, 370 x 500 ft., at the southwest corner of North Menard and Dickens avenues, Chicago, to cost $250,000.

The Stromberg Motor Devices Co., 68 East Twenty-fifth Street, Chicago, has awarded a contract for the construction of a six-story brick factory, 75 x 130 ft., at 2447-49 South Wabash Avenue, to cost $300,000.

The E. J. List Mfg. Co., Havana, Ill., which was recently reincorporated with $35,000 capital stock, is building an addition and is in the market for equipment to manufacture clutches and other devices.

The Rockford Milling Machine Co., Rockford, Ill., is planning the erection of a one-story addition, 53 x 65 ft.

The Roesch Enameling Co., Belleville, Ill., will erect two factory additions, to cost $4,000 and $7,000 respectively.

The Hawkeye Woven Wire Fence Co., Britt, Iowa, has been organized and is preparing plans for a plant. Officers of the company include J. Q. A. McClurg, president; M. G. O'Brien, vice-president, and V. W. Erwin, secretary.

The Minneapolis Heat Regulator Co., Minneapolis, Minn., will erect a two-story addition, 61 x 127 ft., to cost $100,000.

The Fairbanks Co., New York, manufacturer of contractors' supplies, has purchased practically the entire capital stock of H. Channon Co., manufacturer of contractors', mill and factory supplies, 150 North Market Street, Chicago. A new organization of the Channon Co. has been effected and H. G. Elfborg, who has been associated with the Ajax Forge Co. for 23 years, has been elected president. The company is now constructing at the southwest corner of Market and West Randolph streets, Chicago, a seven-story building, which will cost from $900,000 to $1,000,000.

The McInnerney Co., Council Bluffs, Iowa, has been incorporated by B. McInnerney, E. A. Wickham, E. H. Lougee, and others, to manufacture elevators and engage in a general machine shop and foundry business. A site has been purchased and the construction of a plant will begin as soon as building conditions permit.

The General American Tank Car Corporation, Harris Trust Building, Chicago, is planning for the erection of new works for the manufacture of tank cars, flat cars, gondolas and other rolling stock, near New Orleans, La. A site has been selected on the Mississippi River, and the structures will include general iron and steel plant, foundry, machine shop and other buildings, which, with equipment, are estimated to cost about $1,000,000. The company is now operating a plant at East Chicago, Ind., giving employment to about 2500 men, and smaller plants at Warren, Ohio, and Sand Springs, Okla. Max Epstein is president.

The Jewel Electrical Instrument Co., 1650 Walnut Street, Chicago, has filed plans for a three-story brick plant, adjoining its present works, to cost about $50,000.

William G. Garvey, 38 South Dearborn Street, Chicago, is having plans prepared for a one-story plant, 102 x 502 ft., at 5008-18 Bloomingdale Street, for the manufacture of electrical products. It will cost $90,000.

Milwaukee

MILWAUKEE, Dec. 29.

As usual at this season the machine-tool business shows a slackening tendency. Inquiry is brisk, however, and the nature of requests for quotations and delivery indicates that a large amount of requirements will be placed after Jan. 1.

The Brandt-Dent Co., Watertown, Wis., manufacturer of coin handling and counting machines, sustained an estimated loss of $35,000 by fire Dec. 15. Repairs will be made immediately.

The Racine Confectionery Machinery Co., Racine, Wis., has engaged D. R. Davis, local architect, to design a two-story brick and steel factory addition, 50 x 160 ft., and a one-story machine shop extension, 38 x 117 ft., estimated to cost about $75,000 with equipment for which inquiry is being made.

The LaPoint Foundry Co., Hartford, Wis., has incorporated under the style of the Hartford Foundry Co., with an authorized initial capital stock of $10,000. The incorporators are Robert LaPoint, I. L. Bonniwell and Samuel S. Powers. The plant, which makes gray iron castings, was moved to Hartford from Schleisingerville, Wis., about a year ago. An adjoining building has been acquired and will be equipped with an additional cupola. The total floor space has been increased to about 15,000 sq. ft. by the improvement.

The Stinson Tractor Co., Minneapolis, Minn., which established a branch factory in Superior, Wis., last spring, will open a second branch at Eau Claire, Wis., immediately after Jan. 1. Later the main works and general offices will be moved from Minneapolis to Eau Claire, the intention being to reincorporate the present $500,000 Minnesota corporation in Wisconsin and increase the capital stock to $1,000,000. Joseph J. Ott, Eau Claire, has been appointed general manager and will have supervision of the Eau Claire works as well as the branch at Superior.

The Falls Motors Corporation, Sheboygan Falls, Wis., has increased its capital stock from $2,000,000 to $4,000,000 to accommodate the growth of its business and cover additions made during the year and further extensions planned for 1920. The company manufactures internal combustion engines.

The Schmidt Storck Wagon Co., West Bend, Wis., has plans for a one-story brick, concrete and steel factory addition, 100 x 300 ft., 18 ft. high, to be equipped for making hardware and for general woodworking processes. The capital stock is being increased from $50,000 to $150,000 to finance the construction and equipment. Fred Schmidt is president and general manager.

The Northern Motor & Supply Co. of Stevens Point, Wis., has been incorporated with a capital stock of $15,000 to manufacture automotive equipment and accessories. A one-story building, 55 x 115 ft., will be erected early in the spring. The incorporators are J. E. Delzell, M. M. Ames, H. C. Snyder and W. S. Delzell.

The Board of Education, Lancaster, Wis., has engaged Parkinson & Dockendorff, architects, LaCrosse, Wis., to design a new high school and vocational training institute costing not more than $175,000.

The George J. Meyer Mfg. Co., 576-598 Clinton Street, Milwaukee, contemplates extensions of its foundry, machine shop and boiler shop during the coming year. An engineer and architect will be selected soon to prepare plans. George J. Meyer is president and general manager.

The Morneau Sanitary Thermometer Case Co., Appleton, Wis., a $100,000 corporation organized by Dr. J. P. Morneau to make metal cases for physicians' and surgeons' instruments, has leased a factory and is buying equipment. The company has had its product made under contract.

The Davis-Hanson Co., Oshkosh, Wis., manufacturer of pumps and pumping machinery, has changed its corporate style to Davis-Hanson Pump Co., and increased its capital stock from $50,000 to $100,000. The plant on Harrison Street will be materially enlarged. Wilson S. Baker is president and R. W. Wertsch, secretary and treasurer.

The Longdin-Brugger Co., Fond du Lac, Wis., manufacturer of closed body attachments for touring cars and roadsters, has engaged B. E. Mehner, local architect, to prepare plans for a two-story brick factory, 120 ft. sq., to cost about $75,000 with equipment.

The Heaney-Schwab Billiard Mfg. Co., Milwaukee, contemplates the erection of a two-story addition, 60 x 100 ft., at Keefe Avenue and Buffom Street, to cost about $60,000. The architects are Martin Tullgren & Sons.

SHORT TRADE ITEMS

The Fuller Engineering Co., Allentown, Pa., has received a contract from the T. H. Symington Co., Rochester, N. Y., for equipping its malleable melting furnaces with pulverized coal and also a contract from the American Chain Co., which is building a new plant at York, Pa., for a complete pulverizing plant and furnace equipment. The Fuller company built a new pulverizing plant for the T. H. Symington Co. early in 1919 for serving its 20 large muffle annealing furnaces. These are believed to be the first contracts of their kind where pulverized coal is to be used as a fuel for melting as well as annealing furnaces in the malleable industry.

R. F. Sedgley, Philadelphia, announces that the business has been incorporated under the name of R. F. Sedgley, Inc. "Baby" hammerless revolvers and "Hex-all" wrenches will be manufactured.

Patents covering the William & Jeanney system of variable speed power transmission appartus will be sold at auction Jan. 28, at 2 p. m., at the office of M. Dufour, Notary, Boulevard Poissonnière, 15, Paris, France. An upset price subject to possible reduction of 100,000 francs is named and a deposit for bidding of 5000 francs. Application may be made to M. Dufour or to M. Bernet-Rollands, liquidator, 40 rue Notre Dame de Lorette, Paris.

In an article describing a face grinder for work up to 12 in. in diameter described in THE IRON AGE, issue of Dec. 11, page 1195, a caption relative to a pneumatic cylinder on a clamping device for a heavy duty radial drilling machine was inserted in error under the illustration. This caption applies to a machine described in THE IRON AGE issue of Dec. 25, page 1322.

The Gilbert & Barker Mfg. Co., Springfield, Mass., has been awarded the contract to supply the pumps, piping, etc., for the new Strathmore Paper Co. oil tank plant at West Springfield.

A recent fire did $15,000 damage at the Boston plant of the Johnson Ventilating & Heat Regulating Service Co. The George Bryant Electric Co., the Anthes Nickel Plating Co. and the Empire Railways Specialties Co., located in the same building, suffered some damage from smoke and water.

The A. P. McCulloch Machine Co., 216 High Street, Boston, has just moved into its new two-story factory at Sandwich, Mass. The building is 132 x 34 ft., and has 15,000 sq. ft. floor space. W. L. Ross, vice-president of the organization, is in charge. The plant will be devoted to the manufacture of parts for Ford cars. The Boston plant will continue to make dies, etc., with A. P. McCulloch, president, in charge.

The Carnegie Steel Co. has awarded a contract to the Pennsylvania Engineering Works, New Castle, Pa., to rebuild No. 2 blast furnace at Farrell, Pa. The contract involves $350,000. Capacity of the stack will be increased from 350 tons to 500 daily. With this improvement the Carnegie company will have three 500-ton furnaces at the Farrell works.

A section of the American Society of Mechanical Engineers is to be organized at Youngstown, Ohio, its membership to include engineers in the Mahoning Valley. Calvin S. Rice, New York, national secretary, spoke at a preliminary meeting.

In December the second annual nomination and election of representatives under the representation plan was conducted at the plant of the Youngstown Sheet & Tube Co., Youngstown, Ohio. Much interest was manifested in the various departments and some close contests resulted. The election was by secret ballot.

The Trumbull Steel Co. has purchased additional holdings adjacent to its plant at Warren, Ohio, for extensions.

Current Metal Prices

On Small Lots, from Merchants' Stocks, New York City

The quotations given below are for small lots, as sold from stores in New York City by merchants carrying stocks.

As there are many consumers whose requirements are not sufficiently heavy to warrant their placing orders with manufacturers for shipment in carload lots from mills, these prices are given for their convenience.

On a number of articles the base price only is given, it being impossible to name every size.

The wholesale prices at which large lots are sold by manufacturers for direct shipment from mills are given in the market reports appearing in a preceding part of THE IRON AGE under the general headings of "Iron and Steel Markets" and "Metal Markets."

Iron and Soft Steel Bars and Shapes

	Per lb.
Bars:	
Refined iron, base price	4.00c.
Swedish bars, base price	20.00c.
Soft Steel:	
¾ to 1⅞ in., round and square	3.52c. to 3.62c.
1 to 6 in. x ⅜ to 1 in.	3.52c. to 3.62c.
1 to 6 in. x ¼ to 5/16	3.62c. to 3.72c.
Rods—⅝ and 11/16	3.42c. to 3.67c.
Bands—1½ to 6 x 3/16 to No. 8	4.22c. to 4.32c.
Hoops	4.47c.
Shapes:	
Beams and channels—3 to 15 in.	3.47c.
Angles:	
3 in. x ¼ in. and larger	
3 in. x 3/16 in. and ⅛ in.	3.72c. to 3.97c.
1½ to 2½ in. x ⅛ in.	3.52c. to 3.77c.
1½ to 2¾ in. x 3/16 in. and thicker	3.47c. to 3.72c.
1 to 1¼ in. x 3/16 in.	3.52c. to 3.77c.
1 to 1¼ in. x ⅛ in.	3.57c. to 3.82c.
⅞ x ⅞ x ⅛ in.	3.62c. to 3.87c.
¾ x ⅛ in.	3.67c. to 3.92c.
⅝ x ⅛ in.	4.07c. to 4.72c.
½ x 3/32 in.	5.17c. to 5.42c.
Tees:	
1 x ⅛ in.	3.87c. to 4.12c.
1¼ in. x 1¼ x 3/16 in.	3.77c. to 4.02c.
1½ to 2½ x ¼ in.	3.57c. to 3.82c.
1½ to 2½ x 3/16 in.	3.57c. to 3.82c.
3 in. and larger	3.52c

Merchant Steel

	Per lb.
Tire, 1½ x ½ in. and larger	3.52c.
Toe calk, ½ x ⅜ in. and larger	4.35c.
Open-hearth spring steel	7.00c.
Standard cast steel, base price	14.00c.
Extra cast steel	18.00 to 20.00c.
Special cast steel	23.00 to 25.00c.

Tank Plates—Steel

	Per lb.
¼ in. and heavier	3.67c.

Sheets

Blue Annealed

	Per lb.
No. 10	5.07c. to 5.80c.
No. 12	5.12c. to 5.85c.
No. 14	5.17c. to 5.90c.
No. 16	5.27c. to 6.00c.

Box Annealed—Black

	Soft Steel C. R., One Pass, per lb.	Wood's Refined, per lb.
Nos. 18 to 20	6.05c. to 6.80c.	
Nos. 22 and 24	6.10c. to 6.85c.	7.80c.
No. 26	6.15c. to 6.90c.	7.85c.
No. 28	6.25c. to 8.00c.	8.00c.
No. 30	6.35c. to 7.20c.	

No. 28, 36 in. wide, 10c. higher.

Galvanized

	Per lb.
No. 14	6.50c. to 8.10c.
No. 16	6.75c. to 8.25c.
Nos. 18 and 20	6.90c. to 8.40c.
Nos. 22 and 24	7.05c. to 8.55c.
No. 26	7.20c. to 8.70c.
No. 27	7.35c. to 8.85c.
No. 28	7.50c. to 10.00c.
No. 30	8.00c. to 9.50c.

No. 28, 36 in. wide, 20c. higher.

Corrugated Roofing, Galvanized

2½ in. corrugations, 10c. per 100 lb. over flat sheets.

Steel Wire

Base Price* on No. 9 Gage and Coarser	Per lb.
Bright basic	7.50c.
Annealed soft	7.50c.
Galvanized annealed	8.00c.
Coppered basic	8.00c.
Tinned soft Bessemer	9.50c.

*Regular extras for lighter gages.

Brass Sheet, Rod, Tube and Wire

	Base Price
High Brass Sheet	27½c. to 28½c.
High Brass Wire	27½c. to 28½c.
Brass Rod	25¾c. to 28 c.
Brass Tube	41½c. to 43 c.

Copper Sheets

Sheet copper, hot rolled, 16 oz., 32c. per lb. base.

Cold rolled, 14 oz. and heavier, 1½c. per lb. advance over hot rolled.

Tin Plates

Bright Tin		Coke—14x20		
			Primes	Wasters
Grade "AAA" Charcoal 14x20	Grade "A" Charcoal 14x20	80 lb.	$9.30	$9.05
		90 lb.	9.40	9.15
		100 lb.	9.50	9.25
IC	$15.00	$13.00	IC	10.00	9.75
IX	17.25	15.00	IX	11.25	11.00
IXX	19.00	16.75	IXX	12.25	12.00
IXXX	20.75	18.50	IXXX	13.25	13.00
IXXXX	22.25	20.25	IXXXX	14.25	14.00

Terne Plates

8-lb. Coating 14x20

100 lb.	$9.35
IC	9.50
IX	10.50
Fire door stock	12.75

Tin

Straits pig	58c. to 59c.
Bar	63c. to 65c.
American pig, 99 per cent.	57½c. to 59c.

Copper

Lake Ingot	20½c. to 21 c.
Electrolytic	20 c. to 20½c.
Casting	19½c. to 20 c.

Spelter and Sheet Zinc

Western spelter	10c. to 11c.
Sheet zinc, No. 9 base, casks	13c.; open 14c.

Lead and Solder*

American pig lead	8¼c. to 9 c.
Bar lead	8¾c. to 9½c.
Solder ½ and ½ guaranteed	38c.
No. 1 solder	34c.
Refined solder	29c.

*Prices of solder indicated by private brand vary according to composition.

Babbitt Metal

Best grade, per lb.	90c.
Commercial grade, per lb.	50c.

Antimony

Asiatic	10½c. to 11½c.

Aluminum

No. 1 aluminum (guaranteed over 99 per cent pure), in ingots for remelting, per lb. 35c. to 38c.

Old Metals

The market is firm. Dealers' buying prices are nominally as follows:

	Cents Per lb
Copper, heavy and crucible	16.75
Copper, heavy and wire	15.50
Copper, light and bottoms	14.00
Brass, heavy	10.50
Brass, light	7.50
Heavy machine composition	15.50
No. 1 yellow rod brass turnings	9.50
No. 1 red brass or composition turnings	12.50
Lead, heavy	6.00
Lead, tea	4.00
Zinc	5.00